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FOCAL NECROSIS OF THE ADRENAL GLAND: WITH REMARKS UPON ACUTE ADRENAL INSUFFICIENCY.

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Introduction. The lesion is an unusual one. While it has been reported many times, the descriptions have been meager and often inaccurate. Indeed, I have been unable to find a single graphic representation of this lesion in the literature. Moreover, it has never been described as a distinct and unalloyed lesion of the adrenal, and, in consequence, has thus far been nameless. The name I have suggested fits the morphological characteristics accurately; indeed, the resemblance to the more familiar focal necroses of the liver is a very close one. These facts, it seems to me, warrant the purpose of this study, which is based upon two cases observed within a short time.

The study of these two cases led inevitably to an examination of the clinical features of acute adrenal insufficiency, a phase that is always associated, and, moreover, is paramount in nearly all the contributions to the study of this lesion. The reports are so diverse and confusing that it seemed wise at the same time to submit a critique of this aspect as well.

Case I.—H. B., aged forty-one years, male. Admitted October 26, 1913. Three weeks before admission the patient complained of headache, distress in the epigastrium and in the precordium, weakness and anorexia. He had relief for a few days, then the symptoms returned, especially the intense headache. Patient was

dizzy, had flashes before his eyes and there was puffing of forehead and face. The urine showed a trace of albumin and gave a positive test with the guaiac reaction. Roentgen-ray report on October 27, 1913, shows a calculus in the left kidney.

Operation, November 10. Right nephrectomy by Dr. Goodman. Pathological report: Calculous pyelonephritis. Patient was returned to bed in profound shock; pulse, 146. Intravenous infusion given.

November 11. Pulse, 112, poor in quality; temperature, 96 to 97.4°; respiration, 14.

November 12. 8 A.M., pulse, 80; respiration, 16. 12 M., temperature, 93.6°; respiration, 8. 6 P.M., temperature, 93.6°; respiration, 10. 9 P.M., temperature, 96°; respiration, 20. 11 P.M., temperature, 96; respiration, 20.

November 13. Ceased to breathe.

Report on Removed Kidney. The kidney is about twice the normal size; granular surface; capsule not adherent. The pelvis is enormously dilated and congested. It is coated with exudate in many areas and contains bloody purulent urine and one large free stone. The parenchyma of the kidney is pale red; markings poor; cut surface markedly granular; papillæ much flattened.

Microscopically. There is an abundant growth of new connective tissue between the tubules in all stages of organization. The tubules are dilated; the epithelium is flat, granular and stains poorly. Many of the tubules contain hyaline cylinders and fresh blood, especially in the straight papillæ. The glomeruli are fairly well preserved, somewhat contracted; within many of the capsules is a fine granular material. The lining squamous epithelium of the pelvis is well preserved; here and there it is covered by fresh exudate. There is a notable increase of the round cells beneath the epithelium. Diagnosis: calculous pyelonephritis.

Autopsy. Lungs, heart and right adrenal not removed.

Left Kidney. About twice normal size. Surface smooth; dark brownish red. There are numerous punctate, hemorrhagic spots the size of a pinhead. On section, deeply congested; cortex thickened; markings clear; glomeruli easily visible.

Spleen. Normal.

Pancreas. Normal.

Aorta. Moderate atheroma.

Adrenal. Very large, distinct capsule, white center, surrounded by hemorrhagic fat.

Anatomical Diagnosis. Compensatory hypertrophy of kidney, with acute congestion.

Microscopic Examination. Kidney. Hemorrhages in tubules; slight edema of stroma; moderate parenchymatous nephritis.

Spleen. Normal.

Pancreas. Normal.

Aorta. Small amount of lime in media.

Adrenal (Fig. 1). Larger than normal and embedded in hemorrhagic tissue.

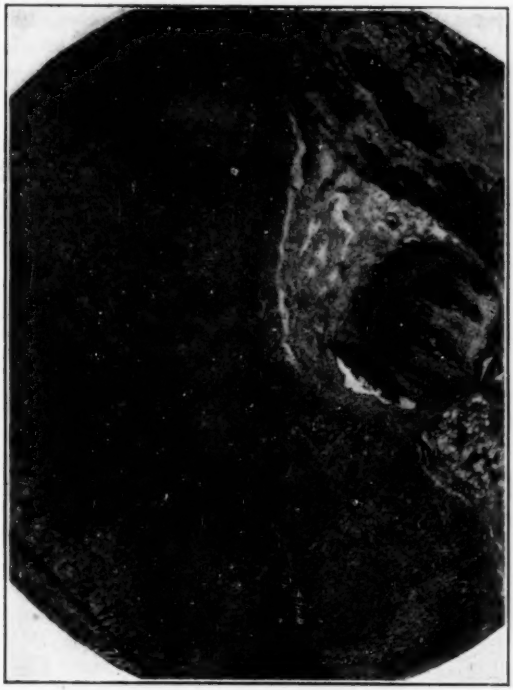

FIG. 1.—Low-power appearance of adrenal from Case I, showing a number of areas of focal necrosis in the cortex and thrombi in the capsular vessels.

With the low power there are perhaps a dozen or more foci where the normal parenchyma of the organ has been manifestly destroyed. These areas are distinctly circumscribed from the surrounding parenchyma and take little or no hematoxylon stain. The majority of these foci have a hemorrhagic appearance, due to the presence of masses of red blood cells. These foci are uniformly round; some are confluent and exist exclusively in the cortex. The medulla is intact. As a rule there is a thin rim of cortex between the foci and the surface of the organ, although some extend to the very surface itself. The majority of these foci have a honey-combed appearance, due to the presence of well-preserved strands of intertrabecular connective tissue.

Upon studying these foci with the high objective (Fig. 2) we find the adrenal tissue has been almost completely destroyed; that

parenchyma cells are mere "shadows" without nuclei or very pale ones. They have entirely lost their normal arrangement and stain deeply with eosin. In some foci no trace of parenchyma whatever is visible, being replaced by a pale acellular tissue resembling fat. Scattered throughout these foci are abundant polymorphonuclear cells. In some foci these are so abundant as to almost warrant the term abscess. The polymorphonuclear cells are distributed evenly throughout the foci; in some, and especially those that reveal the

FIG. 2.—High power of one of the focal necroses, showing intense parenchymatous degeneration and peripheral polymorphonuclear infiltration.

most profound necrosis, the polymorphonuclear cells are densely arranged around the circumference of the focus. These foci also contain abundant red cells. These cells are sometimes distributed haphazardly, as in a hemorrhage. In some areas they are present within dilated capillaries. In addition to these three cellular elements—namely, destroyed parenchymatous cells, polymorphonuclear leukocytes and red blood cells—we find in these foci a fourth element—namely, radially arranged strands of the intertrabecular connective tissue—which give the honey-combed appear-

ance described above. These strands are especially abundant near the periphery of the foci, becoming absent in the central portions.

The parenchyma of the organ between and surrounding these foci are very well preserved. There is some engorgement of the cortical capillaries, and in the medulla a few of the veins are filled with a red thrombus.

The connective-tissue capsule of the adrenal is normal.

The fatty and connective tissue immediately surrounding the organ, however, is intensely hemorrhagic. Especially noteworthy is the uniform presence of hemorrhagic and mixed thrombi in the vessels. The vessels appear greatly dilated and are either completely or nearly completely filled with thrombus consisting of fibrin, with a greater or lesser admixture of red blood cells. The intima is completely absent wherever the thrombus is in contact with the wall of the vessel, but there is nowhere evidence of beginning organization.

Summary. A man, aged forty-one years, with calculous pyelonephritis. Nephrectomy was done. Promptly after the operation the patient went into profound shock. After an intravenous infusion he rallied so that on the following day his pulse was 112, although firm in quality. For the remaining two days of his life his temperatures were subnormal, 93.6° to 96° F., with normal pulse rate and decreased frequency of respiration.

CASE II.[1]—Jennie G., aged eight years, was admitted to the Beth Israel Hospital January 1, 1916. Her parents and their four other children were alive and well.

The child had been nursed until one year of age. She had suffered from a chronic cough from the eleventh month until the end of the second year, when she had a severe attack of measles. During the fourth year it was noticed that the child's abdomen became enormously enlarged and that she steadily lost weight. At that time Dr. Hymanson suspected tuberculous peritonitis, although the temperature was normal and the von Pirquet test was negative. The parents would not permit tapping of the abdomen. On prolonged use of tonics, with creosote, together with good nourishment, the child gained weight, and in the course of eighteen months the ascites almost disappeared.

In the month of May, 1914, the child was brought to Dr. Hymanson and the mother told him that for the previous two months the patient had again been losing weight; had had frequent micturition, with milky urine. The child was very anemic, weighed only twenty-eight pounds and some dulness could be detected at the lower part of the abdomen. The urine looked turbid and fibrinous coagula were observed when it stood for some time. By shaking the urine with ether the dissolved fat rose to the surface and the

[1] For the details of the clinical history I am indebted to Dr. Hymanson.

urine became quite clear. Microscopically the fat globules were in a fine state of subdivision. Sudan III stained the fat particles red. No filaria and no blood had been detected. By advising complete rest, involving absence from school, and the administration of salol, urotropin and belladonna there was slow improvement; some weight was gained, and on July 31, 1915, the urine was examined by Dr. Max Kahn, who reported that it contained a huge amount of mucin, but no lactose, fat or casein.

November 27, 1915, the frequent micturition and milky urine reappeared. Dr. D. Constantinides examined the urine and found albumin, 0.365 per cent.; fat, 0.225 per cent.; also some pus cells and epithelium; no sugar. On allowing the urine to stand a cream-like mass of fat rose to the surface.

Condition on Admission. The child was anemic and very emaciated, weighed only thirty-four pounds, was not playful, complained of frequent frontal headache, was nauseated and vomited several times a day. The heart, lungs and abdominal organs were normal; there was some dulness at the lower part of the abdomen and some nodules could be palpated at the right inguinal region. The glands in both groins were also palpable. There was no edema and no cyanosis. The patellar reflexes were somewhat exaggerated. Temperature, 99.4°; pulse, 120; respiration, 28.

A blood examination showed erythrocytes, 3,800,000; total leukocytes, 14,400; polymorphonuclear cells, 70 per cent.; lymphocytes, 30 per cent. There was no eosinophilia. The hemoglobin was 60 per cent. No filaria were found in the blood.

Von Pirquet tests were done twice, with negative results. Wassermann test was also negative. The stools contained no ova or red cells. The guaiac test for sugar was positive.

The urine also contained lecithin and cholesterin.

The microscopic examination of the urine showed many white cells, a few hyaline casts and bladder epithelia, but no filaria. A diagnosis of chyluria was made.

During the first week of the child's stay in the hospital, under the administration of urotropin and sodium benzoate, her condition improved somewhat and at times the urine almost cleared up, but it always contained some fat. Then the temperature began to rise and reached as high as 104.6°. The headache, nausea and anorexia increased in severity, the urine became loaded with pus, was markedly ammoniacal and the fat was increased in quantity. The stools contained some blood. The cervical glands became enlarged, although there was no congestion of the throat, and some ecchymotic spots were noticed all over the body and extremities. The pulse became very weak and at times irregular.

The eyes were examined by Dr. Ervin Török on January 15, who found that the pupils reacted only sluggishly to light. Both disks were covered with a whitish exudate and were moderately swollen.

There were several hemorrhages on and around the disks. The bloodvesssels were large and tortuous. Diagnosis: albuminuric retinitis.

A blood culture was negative. The same evening and on the following day the patient had a number of convulsive attacks, which were most marked on the right side of the body. These were controlled by chloroform. A lumbar puncture was done, but the spinal fluid was normal.

On January 17 the patient became comatose and the pulse was at times imperceptible. The cervical glands became more enlarged and death ensued from cardiac failure.

Necropsy. A necropsy was performed on the child eight hours after death. The body was very much emaciated. The cervical, axillary and groin glands were enlarged. Some ecchymotic and petechial spots were noticed over the extremities. The *lungs* were normal except for some slight congestion at the bases. The *heart* was much enlarged, the muscle of the left ventricle being about 2.5 cm. thick, firm and pale. The left ventricle was dilated; the muscle of the right ventricle was 1 cm. thick. The valves were normal, with the exception of a few atheromatous patches on the ventricular surface of the mitral valve. The *liver* was slightly enlarged, and on section was pale, brownish red and cloudy. The *stomach* mucosa was covered with mucus, but otherwise normal. The *right kidney* was 8 x 3 x 2 cm. It was very irregular in contour, showed fetal lobulations, and was fairly firm, with adherent capsule. The surface beneath was very irregular, with numerous depressions and sulci between prominences representing remnants of kidney tissue. These prominences were paler than the surrounding portions, project above the surface, and, on section, were grayish and sharply defined from the surrounding tissue. Section through the kidney proper showed a complete obliteration of all markings, so that it was impossible to differentiate cortex from medulla. The cut section was pale red. There were numerous ecchymoses on the surface, the pelvis was somewhat dilated and the papillæ were flattened. The ureters were somewhat dilated and thickened. The left kidney was 6 x 3 x 2 cm., was somewhat smaller than the right and presented practically the same picture, except for the absence of fetal lobulations. Only the left *adrenal* was removed: it was slightly enlarged, otherwise normal. The pancreas was enlarged. The *spleen* was enlarged and measured 12.5 x 6 x 3 cm. The surface was smooth; it was deep red on section and the pulp was firm. Malpighian bodies were prominent. There was a fresh infarct of a dirty brown color, about the size of a bean, in the lower pole, soft in texture and sharply circumscribed from surrounding tissue. The *intestines* were normal. The *mesenteric lymph* nodes were enlarged. The *bladder* was dilated, the walls being extremely hypertrophied; the mucosa was smooth and presented many ecchymotic areas.

Anatomical Diagnosis. Chyluria; chronic diffuse nephritis (contracted kidney); chronic congestion of lungs; hypertrophy and dilatation of the left ventricle; splenic hyperplasia, with fresh infarct; parenchymatous degeneration of the liver; hypertrophy and dilatation of the bladder; hypertrophy and dilatation of ureters.

Microscopic Examination. Lungs. The epithelium of the bronchi was desquamated and the lumen contained an exudate of polymorphonuclear cells. Around the smaller bronchi the alveoli contained an exudate consisting of polymorphonuclears and round cells. The walls of the alveoli in the remainder of the lung were thickened and the capillaries were markedly dilated. The muscular fibers of the *heart* were normal and there was no infiltration. The cells of the *liver* were slightly granular and the nuclei somewhat pale. There was a very moderate amount of fat in the cells.

Spleen. The splenic veins were dilated and filled with blood. The infarct showed profound necrosis, with many "shadow" cells and nuclear detritus. Some of the bloodvessels in the necrosed area were still preserved and contained red thrombi; other vessels showed beginning hyaline degeneration. The splenic veins surrounding the infarct were dilated to an enormous size. The capsule and trabeculæ of the spleen were normal.

The *pancreas* showed a few areas of autodigestion. Scattered here and there throughout the organ were small focal areas of polymorphonuclear infiltrations. In these areas the pancreatic cells stained less deeply than in the remainder of the organ. The islands of Langerhans were normal.

Kidneys. The microscopic picture of the kidneys, even on superficial inspection, showed complete disorganization. The interstitial connective tissue was enormously increased and in areas showed a profound infiltration, with round and plasma cells. The tubules varied greatly in size and in shape; no distinction could be made between any of the various portions of the tubules. The majority of the tubules were dilated and the epithelium was flat and stained poorly. Most of them contain hyaline casts and some of these casts contained polymorphonuclear cells. The glomeruli revealed various forms, some being completely hyaline, some partially so; some contained new connective tissue, others were enormously hypertrophied and others showed a polymorphonuclear infiltration. The Bowman capsules were uniformly intact. A few of the glomeruli contained bacterial thrombi. The capillaries were very prominent and dilated.

The intestines and the mesenteric lymph nodes were normal. In the submucous connective tissue of the bladder there was a marked blood extravasation, but the organ was otherwise normal.

Adrenal (Fig. 3). With the low power the most striking feature is the presence of numerous plugs of bacteria situated immediately beneath the connective-tissue capsule of the adrenal or slightly

beneath it. These plugs are dense and are either perfectly round or sausage-shaped, obviously conforming to the lumen of the capillary in which they are plugged. These plugs exist singly or in groups of two or more, and are usually surrounded by a comparatively small number of polymorphonuclear leukocytes. Many plugs, however, are not surrounded by any reactive zone of leukocytes whatever. On the other hand, we find numerous focal, small collections of leukocytes in which no bacterial plugs can be demon-

FIG. 3.—Section from adrenal Case II, showing bacterial infarct in cortex with slight polymorphonuclear infiltration.

strated (Fig. 4). Some of these focal collections of leukocytes surround a small area of necrotic adrenal tissue, as evidenced by "shadow cells," as in the previous case. The polymorphonuclear infiltration affects the intertrabecular connective tissue.

The capillaries of the adrenal are engorged and here and there is a small ecchymosis. With the exception of a lighter stain than normal the parenchyma of the adrenal is normal.

The connective tissue surrounding the organ shows considerable extravasation of blood. The vessels show no change whatever.

Incidence of Focal Necrosis of the Adrenal. In an examination of many hundreds of adrenals, these are the only two that have shown definite evidence of an inflammatory lesion. My autopsy experience in infectious diseases, it must be confessed, has been rather limited.

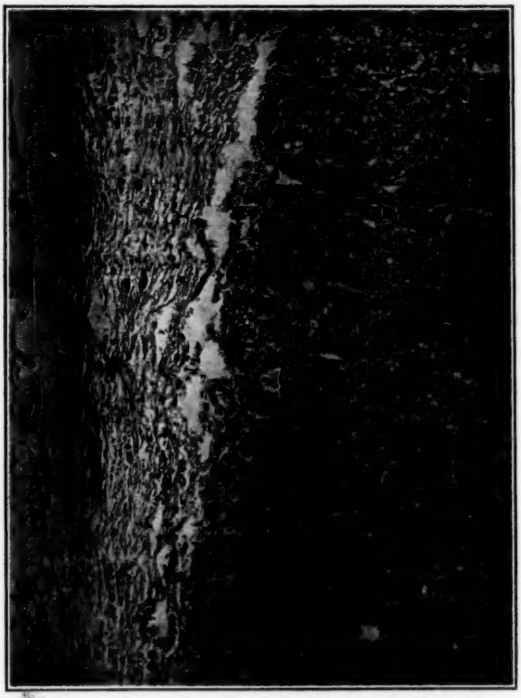

FIG. 4.—Section from adrenal Case II, showing bacterial infarcts in cortex, with practically no polymorphonuclear infiltration.

A study of the literature, on the other hand, confers the impression that inflammatory changes in the adrenal of human beings are not uncommon, although the data are too few to gauge the precise incidence. Babes[2] in a series of 150 consecutive autopsies found acute lesions of the adrenal in 25 cases. In 11 there was hyperemia, with disappearance of fat, sometimes associated with small hemorrhages in the gland and infiltration of the capsule. In these cases one finds foci of polymorphonuclears or mononuclears, with degeneration or necrosis of the parenchyma. In 14 cases of infectious disease Babes found foci of bacteria in the cortex unas-

[2] Compt. rend. Soc. de biol., 1908, lxv, 235.

sociated with secondary inflammatory reaction. Marchetti,[3] in a series of 1200 autopsies, describes congestion and hemorrhage of the adrenals in the infectious diseases. Goldschmidt,[4] in a study of 53 adrenals in all kinds of diseases, found lymphocytic infiltration in infectious diseases and evidences of phagocytosis in the cortex cells resembling in appearance the 'Russel bodies' found in malignant tumors. Ziegler[5] says that small foci of inflammation may occur in the infectious diseases which may pass into suppuration and subsequent scar formation. Aschoff[6] describes edema of the adrenal in infectious diseases as common. Rarer are embolic foci in the cortical zone resulting in "herdförmige" acute inflammations. From these, he says, miliary or even larger abscesses may form. Scheel[7] describes edema of the interstitial tissue of the adrenals as a frequent occurrence in febrile disorders. Neusser and Wiesel[8] say that acute inflammations of the adrenals are not rare; these occur most often in the form of edema and parenchymatous degenerations. He describes focal necroses as occurring in severe infections, especially in diphtheria. Loeper and Oppenheim[9] noted very small leukocytic infiltrations in bronchopneumonia of children, and in streptococcus infections. These same authors[10] have found inflammatory lesions in diphtheria, variola, typhoid and tetanus. They mostly found parenchymatous changes. Focal necroses they noted only in diphtheria. In other diseases, areas of necroses are found, but these are not the direct result of the toxin but are due to hemorrhages. Occasionally they found polymorphonuclear infiltrations of the adrenal. Oppenheim[11] describes cases of dysentery in which, at autopsy, the adrenals were large and congested, with cellular necroses and hemorrhages. Beitzke[12] finds bacterial emboli in the adrenal frequently; often this lesion is the only site of bacterial embolism found at autopsy.

Experimental Acute Inflammatory Lesions of the Adrenal. Much work has been done, especially by the French school, to obtain lesions of the adrenals in animals by the injection of pathogenic bacteria. As far back as 1889 Roux and Yersin[13] found degeneration of the adrenal in experiments in diphtheria. Langlois and Charrin[14] found congestion and hemorrhages in the adrenal after pyocyaneus infections. The most comprehensive experimental

[3] Virchows Arch. f. path. Anat., 1904, clxxvii, 227.
[4] Deutsch. Arch. f. klin. Med., 1909-1910, lxxxxviii, 186.
[5] Specielle Pathologie, Jena, 1906, 11te aufl.
[6] Ibid., Jena, 1912, 2te aufl.
[7] Virchows Arch. f. path. Anat., 1908, clxxxxii, 494.
[8] Erkrankungen der Nebennieren, Leipzig, 1910, 2te aufl.
[9] Manuel des Maladies des Rein, edited by Dehove, Archard and Castaigne.
[10] Loeper and Oppenheim: Arch. de expér. et d'anat. path., 1901, xiii, 683.
[11] Bull. et mém. Soc. méd. d. hôp. de Paris, 1915, xxxix, 1155.
[12] Berl. klin. Wchnschr., 1909, xlvi, 2, 769.
[13] Ann. de l'Inst. Pasteur, 1888, ii, 629; 1889, iii, 273.
[14] Compt. rend. Soc. de biol., 1893, p. 812.

studies are those of Oppenheim and Loeper,[15] who obtained lesions in diphtheria, tetanus, anthrax, and pneumococcus infections. They describe hemorrhages, infiltration with leukocytes, parenchymatous degenerations and necrotic foci; the latter are especially characteristic in diphtheria infections. They found the lesions most often in the recticular and fascicular zones of the gland. Labsin[16] found degenerations and hemorrhages of the adrenals in rabbits and in dogs after injection of streptococci. Crowe and Wislocki[17] found necrotic foci in the adrenal cortex of animals after acute general infections.

These observations upon human beings and animals indicate that inflammatory lesions of the adrenals are not uncommon in the infectious diseases. It would seem that they occur more frequently in experimental bacterial infections than in human beings. Also that such lesions are more common and more profound in diphtheria than in any other infection.

Varieties of Lesions of Adrenals Associated with Infections. As we have seen the lesions of the adrenal associated with infections are various. They may be grouped in the following manner: (1) Parenchymatous degenerations; (2) edema of the interstitial connective tissue; (3) hemorrhages; (4) infiltration with leukocytes; (5) focal necroses; (6) bacterial emboli, with or without secondary inflammatory reaction; (7) miliary or larger abscess. Of these the most common are parenchymatous degenerations and hemorrhages. While some writers, especially those that have written textbooks (Ziegler, Aschoff, Kauffmann, and Beneke[18]) speak of abscesses of the adrenal as not a strange phenomenon, I have been able to find but 3 authentic cases, those of Chvostek,[19] Janowski,[20] and Stursberg.[21] A curious observation is that made both by Beitzke and Simmonds,[22] who found cortical bacterial emboli associated, with parenchymatous degeneration, as the only evidence of bacterial embolism as part of a general infection in the body.

Pathogenesis. So far as available data permits us to judge the lesions in the adrenals may result either from a general toxic action (degenerations, hemorrhages, necroses) or from the action of bacteria themselves (bacterial emboli, abscesses). It seems curious that I have been able to find but few cases of an inflammatory lesion occurring in the medulla of the organ. The lesions that I have described seem to occur mostly in the cortex. Crowe and Wislocki confirmed this observation in their extensive experiments upon

[15] Arch. de méd. expér. et d'anat. path., 1901, xiii, 332.
[16] Arch. de soc. biol. de Petrograd, 1905, xi, 319.
[17] Beitr. z. klin. Chir., 1914, xcv, 8.
[18] Zülzer's Klin. Hand. der Harn. u. sexual organs, Leipzig, 1894.
[19] Wien. med. Presse, 1880, p. 1425.
[20] Gaz. lek., 1898, liv, 354.
[21] Deutsch. med. Wchnschr., 1904, xxx, 1406.
[22] Virchows Arch. f. path. Anat., 1898, clxxii.

acute and chronic infections in animals. The only explanation of this phenomenon I can offer is the peculiar blood supply of the adrenal gland. According to Henle, numerous small arteries from the periphery penetrate into the fibrous capsule of the gland, where they form an anastomosing plexus. These small arteries then penetrate the parenchymal cortex and immediately form capillaries between the cortical columns. From here the blood is collected into small veins in the medulla, whence the blood passes into the adrenal vein. We thus see that bacterial emboli, no matter how small, are promptly caught in the cortical capillaries and have little or no chance to penetrate into the medulla.

If this explanation is valid, the pathogenesis of inflammatory lesions of the adrenal as due to the direct action of bacteria seems the more probable one.

The lesion in my second case is an exquisite example of bacterial embolism.

The lesion in my first case requires a different interpretation. Three explanations are possible:

1. That the lesion was the result of the contagious infection—namely, the pyelonephritis. I do not believe this etiology is probable and for the following reasons: (1) Because it is hard to conceive how an infection of such low grade could cause such an intensely acute lesion. Indeed, so far as I am aware, a focal necrosis in the adrenal has never been observed, either at autopsy or experimentally, in chronic infections. (2) The patient did not reveal any evidence of any grade of general sepsis, either bacterial or toxic.

2. The second explanation is that the lesion may have been due to a postoperation sepsis. Against this explanation is the fact that the patient revealed not the slightest sign of clinical sepsis after the operation.

3. The third explanation, and the one I believe most probable, is that the lesion was due to the peri-adrenal hemorrhage, with consequent thrombosis of the adrenal vessels. My reasons for this belief are: (1) by exclusion of any other factor, and (2) detailed examination of my specimens reveals the fact that the necroses are most abundant in those portions of the adrenals in which the thrombosis of the capsular vessels is most widespread and are correspondingly absent in those portions in which thromboses are absent.

According to this conception the focal necroses in the adrenal may be regarded as infarcts.

Clinical Aspects of Acute Adrenal Insufficiency. The attempt to interpret certain symptoms and signs as due to the obvious interference of function produced by the lesions that I have described is certainly a reasonable endeavor. The French also have been especially active in this field, notably Arnaud, Sergent and Oppen-

heim. Arnaud's[23] contribution appears to have been the first in which a systematic attempt was made to set forth the clinical features of acute adrenal insufficiency, and is based on a study of 80 cases in which hemorrhages, from whatever cause, were found in the adrenals at postmortem examination. Significantly enough, in the vast majority of cases no symptoms that could be directly attributed to the adrenal lesion were present. In 5 cases a hematoma of palpable size was present. In 6 cases the symptoms resembled those of an acute peritonitis. In 8 cases symptoms of so-called "adrenal insufficiency," such as muscular asthenia, prostration, vomiting, diarrhea, abdominal pain, hypothermia, syncope and collapse were present. In 15 cases there was sudden death, or death within a few hours, with symptoms of delirium, convulsions, contractures, coma, hypothermia, syncope, etc. Sergent,[24] who has written extensively on the subject, claims to have discovered a pathognomonic sign of acute adrenal insufficiency in the so-called "white line." This sign is obtained by running the finger-nail or pin along the skin, when a white instead of the usual red line will form. This line is supposed to be due to a temporary constriction of the relaxed vessels. He claims that the triad, "white line," hypothermia and asthenia make the diagnosis of acute adrenal insufficiency certain.

Oppenheim describes cases of dysentery in which there was sudden cholera, like collapse, with hypothermia, concave abdomen, small rapid pulse, vomiting and diarrhea. In some instances he obtained the "white line" of Sergent. At autopsy the adrenals were large and congested, and contained cellular necroses and hemorrhages. Good results were obtained by opotherapy.

Dudgeon,[25] in an extensive study of acute adrenal hemorrhages, admits Arnaud's classification and adds two syndromata of his own: (1) cases suggesting an acute specific fever, and (2) cases with severe skin lesions, such as purpura.

Lavenson[26] reports the case of a woman, aged forty-four years, who suffered from vomiting, epigastric pain, prostration and delirium. The temperature was 98° and the pulse 48 and imperceptible. There was tenderness in the epigastrium and loins. The predominating symptoms were those of shock. She died thirty-six hours after the onset of the illness. At the autopsy there was an acute pancreatitis. There was thrombosis of the adrenal vein secondary to this lesion. The adrenals were enlarged, soft and red, with necroses of the parenchyma and hemorrhagic extravasations. He believes that the symptoms from which the patient suffered were in part due to the adrenal lesion and classifies the

[23] Arch. gén. de méd., 1900, clxxxvi, 5.
[24] L'Insufficience sürrenale, Paris, 1902.
[25] Am. Jour. Med. Sc., 1904, cxxvii, 134.
[26] Arch. Int. Med., 1908, ii, 62.

recorded cases into the following five types: (1) the asthenic form; (2) cases in which symptoms of shock are present, associated with gastro-intestinal symptoms, bradycardia, lumbar pains and death; (3) cases of sudden death; (4) nervous type, with convulsions, coma and delirium; (5) cases associated with purpuric lesions within the abdominal cavity.

Riesman,[27] basing his observations upon Lavenson's report, reports 5 cases of "adrenal insufficiency." The main symptoms were physical weakness amounting to actual prostration, a feeling of coldness, subnormal temperature, slow pulse and low blood-pressure. As all the patients recovered there were no postmortems.

Williams[28] describes cases of neurasthenia or psychasthenia with such symptoms as weakness, low blood-pressure and pigmentation of the mucous membranes. Some die and others recover under opotherapy. He believes that some of these cases may arise after periods of hyperfunction of the adrenals due to mental strain (Cannon).

It cannot be said that the protean and conflicting observations thus far adduced afford a sense of satisfaction, as indices of an acute adrenal insufficiency. Indeed, these form adequate grounds for a critique from many aspects.

In the first place we must remember that the presence of a lesion in an organ, even of such profound physiological import as the adrenal, does not necessarily signify that the lesion gives rise to clinical symptoms. For instance, we know that profound degenerations and almost complete destruction of these organs by metastatic tumors may occur without the slightest evidences of Addison's disease (Kaufmann[29]). Specially significant in this connection are the observations of Arnaud, which we have already quoted, who found that out of 80 cases of adrenal hemorrhage studied, in 46 no symptoms had been present. Obviously the absence of clinical symptoms in cases in which a profound lesion of the adrenal is found at autopsy may be explained in one of two ways: (1) that in many such cases the lesion is unilateral, so that the remaining adrenal assumes the entire physiological function; (2) in cases in which both adrenals are affected, detached portions of unaffected adrenal tissue may be present in the neighborhood or distant parts of the body (*e. g.*, broad ligament, spermatic cord). In any event the absence of symptoms where lesions of the adrenals are present is sufficiently common to make hazardous a clinical deduction based upon pathological findings.

In the second place the function of the adrenal gland is a complex one. The adrenal gland, physiologically speaking, cannot be regarded as a single organ with a single function. Rather it must

[27] Jour. Am. Med. Assn., 1912, lviii, 1846.
[28] Ibid., 1914, lxiii, 2, 2203.
[29] Lehrbuch der path. Anat., Berlin, 1911, 6th aufl.

be regarded as a dual organ, consisting of a medulla and a cortex, each of different embryological origin and each possessing different physiological functions. So far as the physiology of the adrenal has been worked out the cortex functionates to neutralize toxins, bears an obscure relation to the formation of pigment and to the development of some of the secondary sexual characteristics. The medulla, on the other hand, maintains the vascular tone by the elaboration of adrenalin and bears some relation to sugar metabolism. If any of these functions are diminished or absent we could not logically diagnose disease of the whole gland but only of a portion. When we consider, furthermore, that these functions are dependent to a greater or lesser degree upon the activities of other endocrine organs, notably the islands of Langerhans, the thyroid and the pituitary, we can readily understand how difficult it is to create a more or less precise symptom-complex from a disorder of the adrenal function. Certainly the various forms of symptoms-complex that we have quoted bear little relation to the physiology of the organ as we have outlined it. Even in Addison's disease, when the relation of the symptoms to disease of the adrenals has been fairly well established, it is a question as to how far the symptoms, with the exception of the pigmentation, and possibly of the asthenia, are due to the actual involvement of the adrenal gland. Finally, we must remember that the underlying infection causing the adrenal lesion is in itself capable of causing symptoms sufficiently profound to mask or at least modify any possible symptoms arising from involvement of the adrenal gland.

Nor can we accept, without hesitancy, the *post hoc propter hoc* argument of opotherapy as advocated by many. In the first place, adrenalin is only one of the many products of the internal secretion of the adrenal. Even if we admit that it is the most important of the products, it seems illogical to conclude that the administration of adrenalin will save life when we know that at the same time disease of the equally vital essential cortex coexists. Furthermore, the fallacy of judging the life-saving effects of a drug of such unspecific character as adrenalin in conditions that frequently result in cure by other means are obvious.

It seems to me that the only method whereby we may determine clinical acute (and even chronic) adrenal insufficiency is by means of a physiological test. As adrenalin is the only internal secretion of the organ for which we have fairly approximate tests it is logical to assume that the quantity of adrenalin in the blood is a fair index of adrenal insufficiency, provided, of course, that the medulla of the adrenal is assumed to be involved. The clinical possibilities of carrying out such tests was shown by Whipple.[30] Using the physiological test of Elliot and the more accurate chemical test of

[30] Jour. Exp. Med., xix, 536.

Folin, Whipple found that in acute experimental intoxications in dogs the adrenal index is low; anesthesia and chloroform poisoning cause a marked drop; in pernicious anemia there is an increase. In acute infections (typhoid, sepsis, peritonitis, etc.) the adrenal index is either normal or slightly below normal. In cases associated with high blood-pressure the index is normal or slightly subnormal.

A more direct method of determining adrenal insufficiency would be by determining the adrenal index direct from the gland itself. This was done in one case by Cooke[31] in a man acutely ill with delirium and general twitchings. Death occurred two days after the onset. At the autopsy both adrenals were caseous. With the physiological test Cooke found a diminution of adrenalin not only in the diseased areas but also in those portions that appeared normal.

SIDE-LIGHTS ON MULTIPLE MYELOMA.

By Arthur William Meyer, M.D.,

and

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Stanford Medical School.[1]

I like to observe the old saying, "Let not the cobbler judge above his last," but even a cobbler should, I presume, keep his eyes open. I was prompted also to make this report because pathologists, when doing necropsies, usually can make only a partial examination of the skeleton. Hence there are exceedingly few extended and probably no complete skeletal surveys on multiple myeloma in the literature. Then, too, although pathologists are not agreed upon what is and what is not a myeloma, the series of cases is still small. While reporting a case, MacCallum (1901) also spoke of the still rather limited series of cases. Bombhard (1914) was able to find a series of 54 cases without, however, trying to discriminate between the metastatic and the non-metastatic. Since this series of 54 cases contains a number with metastases to other organs than the bones and cartilages, the actual number of cases of restricted multiple myeloma is undoubtedly considerably smaller. In addition to these 54 cases the references before me would seem to show that 6 more cases were reported in 1914 and two in 1915 and perhaps 1 in 1916.

It is not often that a case of this intensely interesting condition comes to the attention of the anatomist, and when it does he usually

[31] Arch. Int. Med., 1912, ix, 108.

[1] The anatomical and chemical portions of this paper were written respectively by Meyer and Swain.

is unaware of the condition until the dissection has progressed fairly well. It is a strange comment upon our management of charitable institutions that this should be so. In case of the body here referred to no information but the data contained on the certificate of death were obtainable even upon subsequent inquiry. These data merely included the name, age, birthplace, occupation of the deceased and the date, the place and the cause of death. The latter, with some justification, was given as "chronic valvular disease of the heart," but the myelomatous condition was apparently completely overlooked.

The body was that of a native of Ireland, aged seventy-one years. It had been preserved in the way customary here, and dissection was begun approximately two years after death. There was no marked evidence of senility or any pronounced emaciation in spite of the very extensive disease shown by the presence of 82 skeletal lesions outside of small foci that may have been contained in the marrow and certain questionable osseous lesions. This number is unique, for although Bender (1902) says that every bone, without exception, was affected in his case, this statement is not supported by his own autopsy report. It is not at all unlikely, to be sure, that some case in the literature upon which only a partial necropsy was made may actually have been affected to a greater extent. But that, too, must remain a matter of conjecture

A rather marked dorsal kyphosis and also a marked right dorsal scoliosis, with slight compensatory lumbar scoliosis, were present in this cadaver. Similar spinal curvatures are also noted in the literature, notably by Bender (1902). Aside from small nodular prominences on several ribs which might have been due to old calluses from fractures, there was nothing to attract special attention to the body except a marked defect in the sternum. Upon palpation a yielding, softened area was found to extend from the lower third of the manubrium to the third rib. A nodular prominence, about 1.5 x 1 x 0.5 cm. in size, was present at the second costosternal articulation, and upon further examination defects were also found in the shafts of the right fourth, sixth and ninth ribs and another several centimeters long near the head of the ninth rib. A similar defect was also noticed at the same point on the left second rib; others at the mammillary line of the left fourth, at the costochondral junctions of the left fifth and sixth and near the angle in the left eighth and ninth ribs.

Upon further dissection it was seen that the trachea was displaced to the right directly cranial to the thoracic aperture and that the innominate artery was prominent, dilated and rather sclerotic. The aortic arch and thoracic aorta were decidedly dilated, extremely sclerotic and calcified. Martiri (1915) also mentions the presence of a pulsating tumor at the base of the sternum and a dilatation of the arch revealed by the roentgen rays. The heart was hyper-

trophied and the left ventricle dilated, but the valves were not sclerotic and looked competent. The rest of the pleura looked normal except for the presence of large partly calcified cartilaginous plaques in the left parietal pleura. One of these lay in the parasternal region opposite the third and fourth ribs. It was 3 mm. thick, 9 cm. long and 5 cm. wide, with the long diameter parallel to the ribs and molded by the latter so that they lay in grooves partly embedded in the plaque. Both pleura and plaques were easily detachable from the thoracic fascia. A similar plaque, 10 x 6 cm. in area and 3 mm. thick, lay on the left dome of the diaphragm, conforming entirely to its curvature. It was roughly oval in shape, with the long dimensions directed transversely. Another plaque lay in the left costal pleura just lateral to the vertebral column, touching the aorta in the region of the eighth to twelfth ribs. It measured 12 x 6 cm., the long dimension lying parallel to the spine. This plaque was triangular, with the apex directed cranially. All three plaques showed some calcification, but looked mainly cartilaginous in gross nature.

Bender (1902) found calcium deposited in zones surrounding the small capillaries of the lung and also in other tissues, and Blatherwick (1916) also spoke of a diffuse infiltration of calcium salts in the lung as revealed by the roentgen rays. Bender, who discusses the so-called calcium metastases in a case of lymphosarcoma and myeloma, says that they occur first in connective tissue, in elastic fibers and in the so-called structureless membranes. All higher organized tissues, such as epithelia, endothelia and smooth muscle, are said to remain free unless they degenerate. Bender concluded, however, that in any case calcium is never deposited in sound tissues and that elastic fibers are the seat of predilection.

The appearance of the connective-tissue framework in the large calcified pleural plaques of this case is shown in Fig. 1. In these specimens apparently all the fasciculi of fibers as well as the interstices of the framework were occupied by calcium deposits.

Except for a dilated bladder and a pronounced hydronephrosis, with marked renal atrophy, especially on the right and probable secondary infection of the kidney and bladder, nothing in the abdominal cavity requires special mention. The spinal arachnoid and pia were decidedly thickened and adherent and the former also contained several small areas of calcification. The dura seemed normal, but the small tumor, about 1 x 0.75 x 0.5 cm., was located in the upper left frontal region about 3 cm. from the midline. It was but very slightly prominent and the dura over it was stripped very easily and was not thickened. Aside from enlargement in the inguinal region the lymph nodes were normal in gross appearance. The fifth right toe was unusually small, pointed and stiff.

As the dissection progressed it was evident that numerous lesions of the bones were present. The ascending ramus of the

right pubis was represented by a thickened, somewhat irregular mass, which had a hard, roughened surface, but yielded on pressure. A slightly prominent, enlarged, soft, circular mass was also seen near the midpoint of the iliac crests. That on the right measured 5 x 4 x 1.5 cm. and that on the left 4 x 3 x 1.75 cm. Similar masses were also seen on the left sides of the bodies of the second and eleventh vertebræ. The head of the twelfth rib was practically destroyed, but the eleventh rib did not seem to be affected. Another large tumor was found on the right dorsolateral region of the body of the eighth dorsal vertebra. This likewise had practically destroyed the head of the corresponding rib. The right halves of the bodies of the first, fourth and fifth lumbar vertebræ were represented by similar tumors which, however, did not seem to invade the intravertebral disks. A still larger mass was contained in the upper right portion of the sacrum.

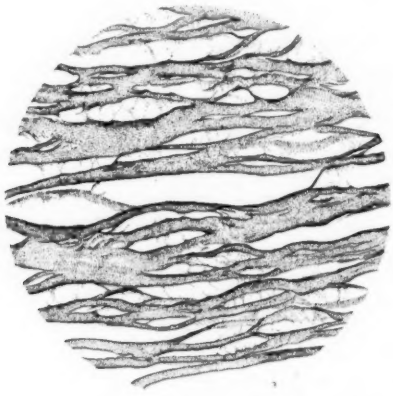

FIG. 1.—Connective-tissue stroma in one of the calcified pleural plaques. Magnification, 375.

A large tumor, about 3.5 cm. in size, was found below the right glenoid cavity, and this directed attention to a most interesting condition in the right humeroscapular articulation. The subdeltoid bursa was normal, the joint capsule intact, but slightly thickened superiorly, and the long head of the biceps unaffected. But on opening the joint a large pyramidal defect was seen in the superior anterior articular surface of the humeral head. Bombhard states that in the case reported by Herz the head of the right humerus was almost completely destroyed and in Bender's (1902) case the head of the right humerus was also affected.

The inferior two-thirds of the glenoid cavity was represented by a thin remnant of this portion of the articular cartilage only.

This remnant was displaced backward some distance, so as to permit the remaining portion of the scapular head to fit into the humeral defect. The subscapular bursa was much enlarged and apparently filled with a granular mass. It measured 3.5 cm. in length, 2 cm. in width and 1 cm. in thickness. Upon opening it the contents were seen to be composed of 6 grams of ground-up bone and fibrous remnants, which looked not unlike sawdust. Blood-clot or exudate was not present and the bursa still communicated with the articular cavity, which contained many villi.

FIG. 2.—Defect in right humeral head, one-half natural size.

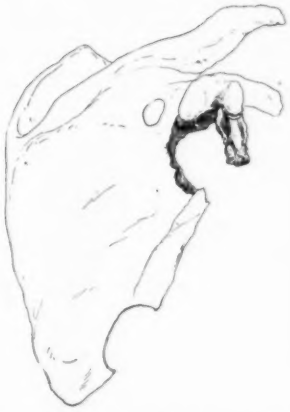

FIG. 3.—Defects in the right scapula, one-third natural size.

Upon further examination it was found that the myeloma below the scapular head had destroyed two-thirds of the head, neck and articular surface of the scapula, leaving only the thin cartilaginous disk mentioned above, which was only several millimeters thick. Nevertheless, the original articular surface was still preserved. Smaller tumors were also noticed at the base of the scapular spine, and a larger one, about 3 x 2.5 cm., on the lateral surface near the inferior angle. The cartilage of the remainder of the humeral head was roughened, atrophied and partly eroded, except for a rim about 0.5 cm. wide near the periphery of the head. The defect in the humeral head measured 3.5 cm. across at the base, 3 cm. in a vertical direction and 1.5 cm. in a direction transverse to the head and to the midpoint of its base. Connective tissue from the capsule had proliferated over the anterior margin of the defect, very small portions of the anterior extent of which seem to be covered by cartilage while other small portions are polished (Figs. 2 and 3).

Although all the tumors seemed to be confined to the bones, a careful inspection of all the other organs was made, but not a single lesion was found outside of the skeleton, including the cartilages.

The tendency seems to be to reject those cases in which metastases occur to other organs than the bones or ossified cartilages from the class of true myelomata. Borst (1902) also emphasizes this aspect of the disease. However, Christian (1907) states that Lubarsch (1906) thinks that metastases to other organs are possible. Nevertheless, Lubarsch writes very explicitly, "Ich stehe somit auch auf dem Standpunkt dass das Myelom keine Metastasen macht" (Lubarsch (1906), s. 217). Bombhard (1914) says his case supports either view, and adds that in several instances metastases have even been reported in the muscles. One of Christian's cases and likewise one of Hoffman's also had metastasized to other organs than the bones and cartilages.

FIG. 4.—Exostoses on the distal extremities of the fibulæ.

Next to the very large and numerous defects and tumors and the deformed phalanges the thing that attracted attention to the skeleton was the presence of a general roughening on the cleaned bones, which was very pronounced in the fibulæ. This was due to the presence of plaques, spicules and larger spines or to scores of small sharp exostoses. This roughening was not present on the entire surfaces of the bones, however, and often looked more like a calcareous deposit than like true bone. It was present as plaques over practically the whole of the middle and posterior cerebral fossæ, but practically absent on the rest of the internal and external

surfaces of the skull. The clavicles, ribs, spine, and pelvis showed but little of this deposit, but the long bones of the extremities showed somewhat more, especially near their proximal extremities. However, in the case of the fibulæ the roughening formed by masses of small exostoses, up to 0.5 cm. long, was confined largely to the medial and anterior surfaces of the distal halves, as shown in Fig. 4. The ossa calces, too, were roughened quite extensively.

Aschoff also commented on the slight tendency to bone formation, but Bender (1902) says that resorption within the bone is offset by deposition in many places. Bender reported signs of direct ossification of connective tissue and also of indirect bone formation through an intermediate cartilaginous stage.

In several of the cases in the literature it is stated that considerable softening of the bones was present, especially in the vertebra and near the tumors. Bender, too, speaks of osteoid margins, and Borst (1902) says that the diseased bones not only showed much osteoporosis but the softening of a senile osteomalacia as well. In the case referred to by Borst the vertebra could all be cut with a knife. A softening of the bones is mentioned in some other cases also, but was completely absent in the case reported here, except in the immediate proximity of the tumors of the vertebræ. Indeed, there was not only an entire absence of softening but also an entire absence of senile atrophy. This became especially evident upon section of a number of the bones, including some ribs, the calvarium and a group of long bones.

In addition to the more or less general roughening of the bones there was evidence of arthritis. The bodies of most of the vertebra show some lipping, and some of them also possess small polished areas. Both lipping and polishing are present on the articular surfaces between the dens and the atlas. The bodies of the sixth and seventh cervical vertebra are synostosed anteriorly. The bodies of the seventh to twelfth dorsal vertebræ inclusive are likewise synostosed anteriorly by thick knob-like arthritic deposits. The first and second lumbar vertebræ likewise are synostosed, but in this case probably through the formation of new bone in consequence of or in accompaniment with the myelomatous condition. The right coxal bone is synostosed with the sacrum along the superior margin of the sacro-iliac synchondrosis, and some of the interphalangeal articulations are eroded slightly. To what extent the remarkable changes in the phalanges shown in Fig. 5 were due to the myelomatous condition will be considered farther on. The articular surface of the left greater multangular and the corresponding area on the first metacarpal are eroded and polished and the former is decidedly lipped.

In addition to the very marked absorption in the metatarsals and toes shown in Fig. 5, which may be related to the arthritis, marked absorption is present also on the inferior surfaces of the

maxillæ. This absorption is so very pronounced that only a very small low ridge, which anteriorly and anterolaterally is almost imperceptible, marks the boundary between the inferior and lateral surfaces of the left maxilla as shown in Fig. 6. Not even in the most senile skulls in my possession, some of which show the most pronounced absorption and belong to a later decade in life, show such marked absorption in the alveolar region. The other bones of this skeleton, on the other hand, show practically no evidence of senility whatever.

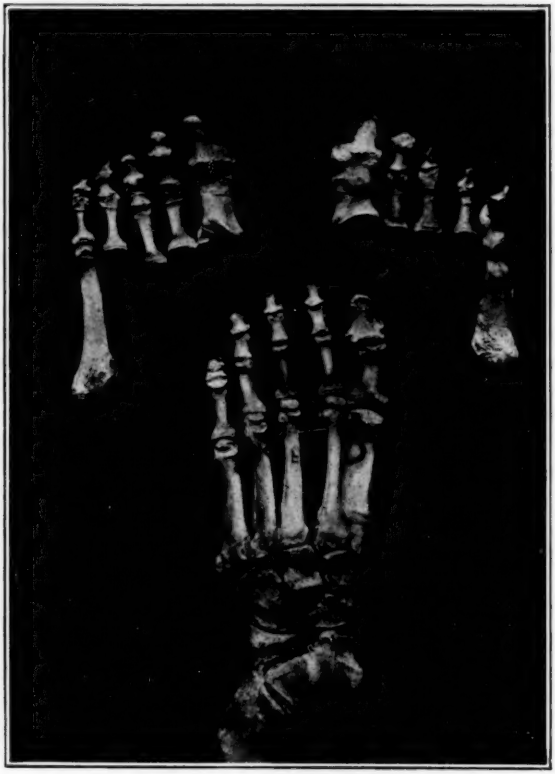

FIG. 5.—Toes and fifth metatarsals and a normal foot.

An examination of the bones shows that the tendency to bilateral symmetry of the lesions was but slight. A number of the lesions in the pelvis were symmetrically located, however, and both scapulæ were affected, although not symmetrically so. In the flat bones the defects when involving the entire thickness of the bones are quite

circular. When they did not involve the entire thickness or when not limited by cartilages, as in case of the vertebræ, they are spherical. The superficial defects are irregular in form and depth as a rule. It was only in case of the costal cartilages that extensions of small processes of the subperichondrial tumors into the interior of the cartilages was noticed. Von Verebély (1906) seems to have reported the only other case in which the cartilages were affected, and said that this fact added a peculiar interest to his case. In the latter case a tumor in the cricoid cartilage almost obstructed the lumen

FIG. 6.—Undissected portion of the base of the skull, showing complete partial obliteration of the alveolar process and a superficial lesion on the left articular eminence.

of the larynx. Von Verebély added that the tumors in the larynx and sternum were at first taken for gummata. A deep scar on the glans in the present case similarly misled me, upon inspection of the cadaver when the lesions in the sternum and ribs were first noticed.

Since the costal cartilages showed no ossification the presence of tumors in several of them was very puzzling until examination

showed that small microscopic remnants of bone were still left in the two cartilages affected. Hence it is clear that we are dealing merely with an extension of the disease to areas of previously ossified cartilage. This was also true in the case reported by von Verebély, the only other case in which cartilage was noticed to have been affected. That cartilage is not affected primarily would also seem to be indicated by the entire absence of invasion of any of the intervertebral disks. In typical cases it seems there merely is a protrusion of the tumors through the bone into the surrounding tissues. Bender (1902) states, however, that in his case the tumor cells had invaded the intervertebral disks in certain hemorrhagic areas, and Borst (1902) says that the round cells had infiltrated the inner layers of the periosteum, but adds that it is only rarely that the tumors reach or penetrate the latter. I saw no involvement of the periosteum, although the fibrous trabeculæ of the tumors are not infrequently directly continuous with it. This was shown especially well in case of the tumors in the two costal cartilages where extensions from the perichondrium (periosteum?) went directly into the tumor. Very many, in fact most of these 82 tumors, reached the periosteum, however. But even the large tumors which had completely deserted portions of the body of the sternum had not invaded the costal cartilages, although several of the chondrosternal joints were involved. Indeed, the periosteum or the adjacent muscles were involved nowhere and none of the tumor were more than slightly prominent. This was true even of the largest, which measured 4 to 5 cm. across.

The articulated pelvis shows that it yielded under the effect of the body pressure (Fig. 7). Since the right superior ramus of of the pubis is completely destroyed for a distance of 3.5 cm. and the ramus of the ischium an equal distance in a line directly below, this need not surprise us. Especially not if we bear in mind that the superior pubic ramus on the left was fractured, and that not only the inferior pubic ramus on this side is almost completely divided, but also the ramus of the left ischium directly opposite the inferior extremity of the obturator foramen. The right coxal bone has been displaced upward, rotating the sacrum to the right. The upper border of the symphysis is directed to the right and lies opposite the right upper anterior sacral foramen.

As one looks at the pelvis it is indeed difficult to see how it could have been possible for the patient to stand with comfort, much less to walk. The lesions are so many, the defects so large and the destruction of important portions of the pelvis so complete that it would seem as though this individual must have been bed-ridden for months. Yet there were no bed-sores, and in the absence of a clinical history the existence of a paraplegia remains purely a matter of surmise, except, perhaps, for the light that the presence of a very pronounced hydronephrosis throws upon this question. Since there

was no obstruction of the ureters it is difficult to see any other explanation for the astonishing atrophy of the renal parenchyma than the presence of a paralyzed bladder. The condition of the latter as well as the great destruction in the lumbar vertebræ and the sacrum, also confirm this supposition. Hence, it would seem that the individual was probably paralyzed in the lower extremities, at least during the later stages of the disease.

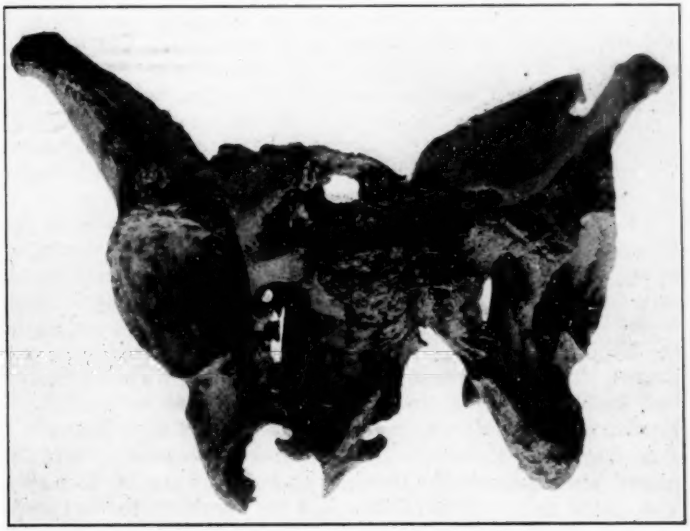

FIG. 7.—Pelvis as seen from the front and right, showing destruction of a considerable portion of the right superior ramus of the pubis and of the ramus of the ischium. The defects are not all visible.

The condition of the phalanges was an exceedingly interesting one and at first sight reminds one somewhat of the atrophy in leprosy as shown by Harbitz (1910). The deformity in the fifth metatarsal, of the first phalanx of the fifth toe and of the second and terminal phalanges of all the toes on the right foot is especially interesting, however. The presence of some deformity in the toes was noticed upon external inspection of the cadaver, but was at first given no further attention, because it seemed more probable that local disease, or accident even, might well be responsible for the curious condition which seemed to exist. The condition of these toes makes one think of arthritis deformans. The absorption of bone is extremely marked, however. The phalanges of the great toe are thoroughly fused and some absorption is evident on the ventral surface.

The terminal and middle phalanges of the second toe must have fused some time before the terminal phalanx was fractured and the distal half displaced plantarly, so as to form an angle of about 80 degrees. These phalanges were united by fibrous tissue, the articular cartilage having been destroyed.

The terminal and middle phalanges of the third toe also had fused. The second phalanx was almost completely absorbed and the middle phalanx rotated 90 degrees counter-clockwise.

The second phalanx of the fourth toe had fused with the first and only a very small remnant of it remained. The terminal phalanx of this toe showed great absorption and the articular surfaces between it and the second phalanx were destroyed.

The first and second phalanges of the fifth toe also were fused and greatly deformed as Fig. 5 shows. The terminal phalanx, on the contrary, was very well preserved, although rotated laterally 90 degrees.

The absorption present in the foot was most pronounced in the fifth right metatarsal. The head of this bone is completely destroyed unless one can consider an irregular process with a very rough articular surface as a remnant of it. The proximal third of the bone is quite well preserved, however, although the plantar surface of the distal three-fourths shows a thin, wide ridge formed by a new deposit. This ridge of bone was 0.5 x 3 cm., and with a much smaller wall medially, included the tendons of the muscles between them. Erosion and polishing were present in a number of these joints.

As shown in Fig. 5 marked absorption was present in some of the second, and especially the terminal phalanges of the left foot also. The second and terminal phalanges of the fourth left toe had fused and the latter was changed into a many-pronged, very irregular process. Some absorption was present also in the first phalanx of the fifth toe.

Old, completely healed, well-united fractures were present in the sixth, seventh and eighth ribs on the right side. These fractures, which are located about in the mammary line, all healed without any displacement and without callus formation, the shafts simply being slightly depressed. The sixth right rib, however, also shows a fracture farther medially. At this point there is a marked callus which looks, however, as though it were due to the presence of a tumor, for the thickening of the bone at this point is specially marked when compared with the slight diffuse thickenings at the other points of fracture. Aside from these fractures, most of which seemed old, there were a few others in the pelvis aside from the one mentioned in the description of the spine and another one indicated in one of the toes. In the superior ramus of the left pubis also an old, well-healed fracture line is clearly visible. There is almost no callus medially and inferiorly at this point and no displacement whatever seems to have occurred, although this fracture was

located just medial to the pectineal eminence. A moderate amount of callus is present superiorly and laterally, however. Another line of fracture, with considerable callus formation, is present in a line directly below, in the inferior ramus of the pubis, where a tumor has left only a thin shell of bone superiorly.

The complete destruction of the superior ramus of the right pubic bone and part of the ramus of the ischium also suggests that fractures were likely present here, although but little callus or new deposit could be found anywhere. Moreover, the displacement and the increased mobility were so slight that the marked destruction at these points did not attract attention until a careful search was made for the other less evident lesions elsewhere. The small amount of callus present is indeed a very striking thing, and the callus, or new bone formation, seems to have been limited very largely to fracture lines, and where more or less motion was inevitable. It is also interesting that as much or even more deposit of new bone, which always looks more like a calcareous deposit than true bone, can also be found in places where no fractures had occurred. However, Aschoff found stalactite formations near old healed fractures in the pubic rami, and Borst emphasized with an exclamation point the fact that some fractures found in his case had healed.

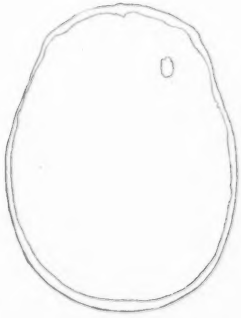

FIG. 8.—Outline of calvarium showing size and location of the lesion, one-third natural size.

SKULL. As noted above, only a single tumor was found in the fresh skull. As shown in Fig. 8 this was located in the upper left frontal region. The defect in the inner table occupied by this tumor has an oval form and measures approximately 1 x 0.75 cm. This leads into a slightly larger cavity, about 0.5 cm. deep, from which the myeloma was very easily removed. There also is a small superficial defect in the right posterior cerebral fossa and a similar superficial defect in the right cerebellar fossa. There are the only signs of lesions noticeable upon inspection of the interior of the skull.

The exterior seems to be entirely free except for a small superficial excavation on the left articular eminence shown in Fig. 6. This area is about 1 cm. in a transverse and 0.5 cm. in an anterior posterior direction and about 0.5 mm. deep. It is studded with numerous small pits. The appearance of this area can leave no doubt that the destruction here is due to action from the surface.

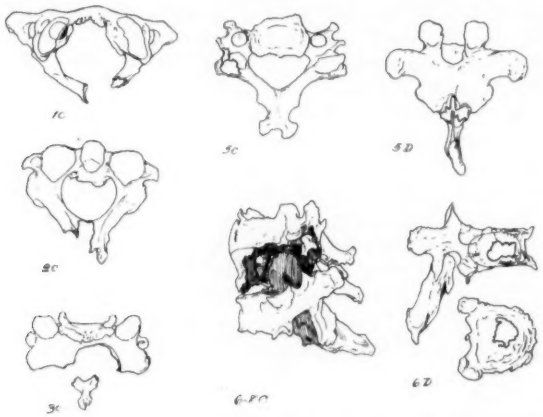

FIG. 9.—Affected cervical and upper six dorsal vertebræ, one-half natural size.

VERTEBRAL COLUMN (Figs. 9 to 12). A small cavity 3 x 4 x 4 mm. deep, open to the surface, is located just dorsal to the tubercle for the left extremity of the transverse ligament of the atlas. The superior portion of this tubercle is perforated by almost a dozen fine canals, about 0.25 mm. in diameter. The articular surface for the dens is decidedly lipped, especially near its superior margin, and most of this area is polished. As shown in Fig. 9 the spine and part of the right arch of the atlas were destroyed.

The left half of the bifurcated spine of the epistropheus and part of its adjoining left arch are destroyed.

The spine of the third cervical vertebra and the adjoining arches are completely severed from the rest of the arch.

The inferior two-thirds of the articular surface of the fifth cervical and the dorsal surface of the base of the arch were invaded for about one-half of their depth, as shown by a roughened excavation about 2 cm. in size.

The base of the left transverse process and the left four-fifths of the body of the seventh cervical vertebra were destroyed.

The spine of the fifth dorsal was almost completely separated at its base and the adjacent arch looked as though the disease had begun superficially here rather than within.

As shown in Fig. 10 the seventh to the eleventh dorsal vertebræ were fused into a single mass by deposits on the ventral surfaces of their bodies and by lipping of the articular surfaces.

A large defect, 2 x 1½ cm., opens from the dorsal surface of the body of the eighth dorsal vertebra into a large cavity in the interior, so that only a thin outer shell is left of the body of this vertebra. Both pedicles are completely severed and partly destroyed and the spine is affected at about its midpoint.

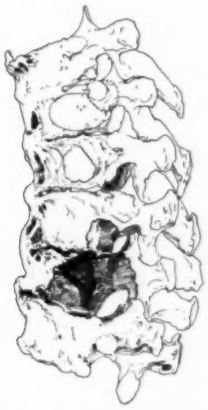

FIG. 10.—Affected seventh to twelfth dorsal vertebræ, one-half natural size.

An excavation, about 1 x 1½ x 1 cm., is located on the left side of the body of the ninth dorsal vertebra. The adjacent surface of this vertebra also looks as though it had been affected. The pedicle on the left side is destroyed for almost one-half its width, and there also is a superficial worm-eaten area, about 0.5 cm. wide, at the left margin of the body of this vertebra just caudal to the radix.

The left radix of the tenth vertebra is destroyed almost up to the articular surface. The portion of the body caudal to it has a superficial defect over an area of almost 2 sq. cm.

The greater part of the body of the left radix of the eleventh dorsal vertebra is destroyed. A large defect looks backward and to the left.

The right transverse process of the twelfth dorsal was completely severed and almost destroyed.

As shown in Fig. 11 the defects in the lumbar vertebræ were still greater, for the body of each of these vertebræ is very largely destroyed. The first and second lumbar vertebra are fused, the right two-thirds of the body of the first lumbar vertebra are gone and the right lamina is affected. The left half of the body of the second is likewise destroyed and a superficial oval excavation,

2 x 1 x 0.5 cm., is also found on the left dorsal surface of the body of this vertebra, mediocaudally from the radix. The body of the third is almost completely excavated from its dorsal surface, the cavity reaching the surface, both cranially and caudally, by means of apertures about 1 cm. in size. The right half of the body of the fourth lumbar and the dorsal third of its spine are destroyed. The anterior surface of this vertebra is also denuded of compacta for the entire height of the body over an area about 1½ cm. wide. This denuded area is not more than 2 mm. deep. The right articular process of the fifth lumbar vertebra is detached at its base and the left third of the body is destroyed. The base of the left superior articular process is also affected, the left inferior articular process is detached at its base and the left transverse process destroyed. The right transverse process was fractured and shows some callus formation on its inferior surface.

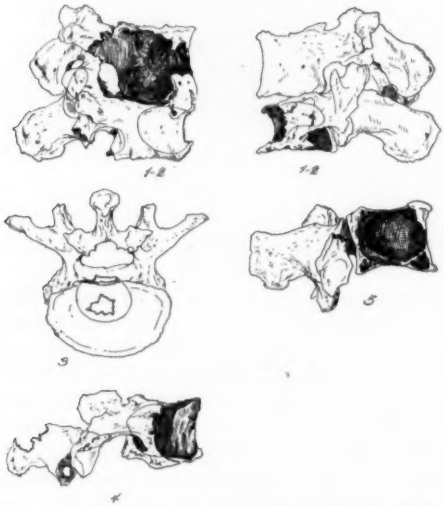

FIG. 11.—Lumbar vertebræ, one-half natural size.

The body of the first sacral segment is almost entirely destroyed by a large central excavation which is continuous dorsally with a similar excavation in the left ala, but which has not yet reached the auricular surface (Fig. 12). The anterior inferior extremity of the latter is invaded upon by a superficial oval excavation about 2 x 1 x 0.5 cm. The superior surface of the right ala also looks as though it had been affected. There is a good deal of deposit on the anterior surface of the second upper sacral segment, but no signs of fracture are present. The right inferior half of the body of the

second and the adjacent portion of the body of the third segments, including the intervening transverse process, are destroyed.

FIG. 12.—Sacrum with beginning of synostosed right ilium indicated, one-third natural size.

RIGHT RIBS. The first rib is completely divided in the region of the tubercle, over an area about 1 x 0.5 cm., on the superior surface near the dorsal margin and on the inferior surface opposite the sulcus subclavii. In the latter area the compacta contains numerous small pits, some of which are placed opposite others on the inferior surface, thus forming small canals. This portion of the rib looks worm-eaten, and again as though the disease had penetrated from without.

The fourth rib contains two tumors, about 0.75 cm. and 1.25 cm. in size, located near the middle and about 4 cm. apart. The largest of these tumors has completely destroyed the shaft and the smaller, more distant one, has almost done so.

In the fifth rib there is a defect about 0.5 cm. in size and 5 cm. medial to the angle of the rib. It is located near the dorsal border and has almost penetrated the compacta on the external surface. The compacta within is completely destroyed at this point.

There is a worm-eaten area on the superior surface of the sixth rib near its angle. This area in the compacta is about 1 cm. in size and oval in form. Most of the pits located here perforate the compacta. There also is evidence of an old tumor, with calcification, on the shaft of this rib about 7.5 cm. from its dorsal extremity. The shaft here is partly destroyed. A third tumor, about 0.5 in size, was located within 2 cm. of the costochondral junction. This seems to be at the site of an old fracture, and there also is an old healed fracture near the middle of the shaft of this rib.

There is evidence of an old lesion, about 1.75 cm. in size, near the center of the shaft of the seventh rib. There is a rounded prominence on both surfaces formed by calcifications.

The shaft of the eighth rib, in the region between the head and the tubercle—that is, the neck—is almost completely destroyed. There also was a small tumor on the inferior surface of the shaft in the mammillary line.

There is a slightly prominent, rounded area of calcification about the middle of the shaft of the ninth rib.

The superior surface of the head of the eleventh rib was slightly affected.

LEFT RIBS. A portion of the shaft of the third rib, between the tubercle and the angle, is gone. The shaft of this rib is almost completely severed, for a distance of about 2.5 cm., near its midpoint.

There is an old fracture at about the midpoint of the shaft of the fourth rib.

About 1.5 cm. of the shaft of the sixth rib is completely destroyed at a point 5 cm. from the costochondral junction. The midportion of the shaft of the eighth rib is completely severed and the same is true of the lateral extremity of the medial third of the ninth rib.

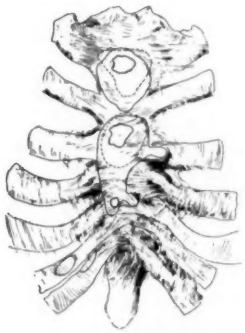

FIG. 13.—Outline drawing of the moist sternum, showing the location and size of the lesions in both bone and cartilage, one-third natural size.

STERNUM. The sternum, and some other bones was not cleaned in order to enable us to make a histological and chemical examination, if necessary, of the costal cartilages, but the size and location of the lesions is shown in Fig. 13. The caudal half of the manubrium of the sternum is occupied by a tumor which has destroyed the bone over the greater part of this area, leaving only a thin outer shell, which is still preserved on the anterior surface. Internally the tumor reaches the periosteum. Caudally it extends a little below the sternal angle, measuring approximately 3 cm. across. The second costal cartilages seem to be unaffected. The cranial portion of the corpus is completely destroyed and the third chondrosternal articulations are involved. This tumor extends down the right side of the sternum, involving also the fourth and fifth chondrosternal articulations. A marked nodular thickening is found on the third left chondrosternal articulation. At this point there is a hard, rounded prominence, 1 cm. across and 0.5 cm. high. Although the third, fourth and fifth right sternochondral articulations are also

affected, there are no prominences at these points. A small tumor is also found more caudally in the corpus. It is of particular interest, however, that the seventh right costal cartilage is affected wholly independently of an adjacent tumor. This cartilage is penetrated for about one-third of its thickness at a point about 3 cm. from the chondrosternal junction. The surface of the tumor is about 0.25 cm. large and somewhat irregular in form. The sixth right costal cartilage is also affected about 4.5 cm. from the sternochondral junction. A tumor, about 0.75 cm. across and 0.25 thick, is found on the superior surface. The muscles here as elsewhere are entirely normal and uninvaded and no changes can be seen in the perichondrium.

There also is a hard, darkened area on the superior external border of the fifth left costal cartilage. This area looks spongy, the surface being formed by a thin shell of bone, and the affected area being about 1 mm. deep, 5 mm. long and 4 mm. broad. This area is quite unlike anything else seen in this case and is probably not due to the disease.

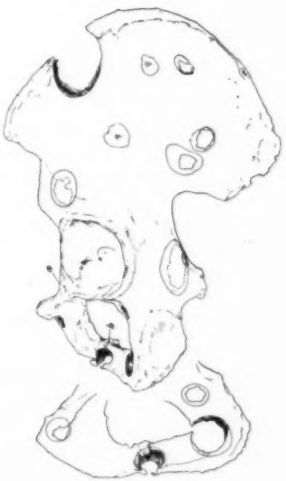

FIG. 14.—Lateral view of the left coxal bone with the inferior portion shown separately, one-third natural size.

COXAL BONES. There are ten comparatively large defects in the left coxal bone, as shown in Figs. 7 and 14. These areas of destruction, some of which involve the entire thickness of the bone, vary from 1 to 3.5 cm. In addition to these ten areas there are two smaller ones, indicated by a question mark, which look as though the disease had just begun at these points. Had we sectioned this

bone we undoubtedly would have found indications of other lesions, but we preferred not to destroy the specimens, since the number of tumors revealed is already an exceedingly large one, and especially since the revelation of a few more small foci of disease would probably not throw any additional light upon the condition.

FIG. 15.—Medial view of the right coxal bone in bisected outline.

There are four large defects in the right coxal bone, shown in two parts, in Fig. 15. In addition to these there is a superficial defect on the external surface near the superior posterior iliac spine. This is 1 x 0.5 cm. in size, and there is another focus, 1 cm. in size, on the internal surface, making six areas of destruction in all. The size of the areas varies from 1 to 5 cm. One of the larger ones involves a portion of the acetabulum and all of the superior pubic ramus.

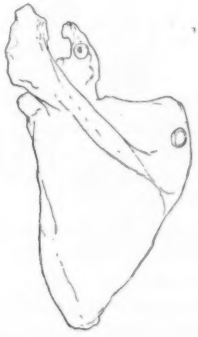

FIG. 16.—Left scapula, one-third natural size.

THE UPPER EXTREMITIES. The acromial extremity of the right clavicle is affected, especially on the surface of the distal extremity.

This area of disease was located between the cartilage and the bone. MacCallum (1901), in one of his cases, also found the end of the left clavicle distended by a tumor and the right fractured. Aside from the two tumors on the scapula and the defect in the head of the humerus, already described, no lesion was found upon examination of the fresh cleaned and cut moist specimens of the bones of the right arm. Since it was desired to use some of these bones for chemical analyses we did not clean them as we did most of the rest of the skeleton. All joints were opened, however, and the articular surfaces carefully examined. There is an area of disease, about 1 cm. in size, near the base of the coracoid process of the left scapula, and another small area near the superior angle (Fig. 16). The latter is interesting in that a fine framework of bone still remains over the entire extent of the lesion, the disease having penetrated the substance of the bone completely at many points and not completely in others.

FIG. 17.—Proximal portions of the left femur, one-third natural size.

LOWER EXTREMITIES. No evidence of the disease was found in the right leg, even upon section of the bones.

An opening about 1 cm. in size, at a midpoint, was found on the ventral surface of the left femur on a level with the caudal portion of the lesser trochanter (Fig. 17). On a sagittal section of the dry, clean bone it is seen that this opening leads into a spherical cavity in the spongiosa. The ventral compacta is also involved in the formation of this cavity, which measures 3 cm. in diameter. No other lesion was noticeable, even on section of the rest of the bones of the left lower extremity.

Although Bender (1902) stated that one cannot speak of a definite structure of the tumors in multiple myeloma, this is not true in a macroscopic sense in this case. Except for the different reactions to pressure which go with differences in size all were very much

alike. All were decidedly spongy and yielded to pressure, though firm and elastic. All tumors could very easily be removed, leaving a remarkably clean surface of wholly normal or almost normal spongiosa. The ease with which they were shelled out was largely due to the fact that the absorption of the compacta had almost kept pace with that of the spongiosa. The former formed only a small projecting margin in case of the larger tumors and was never lifted up, as in one of the cases spoken of by MacCallum (1916). There was no displacement whatever of the old compacta, the prominence in all instances being due to slight protuberance of the tumors or to calcareous or bony deposits. There was no difficulty in stripping the periosteum from the larger tumors, which included more than the majority of the 82, because of extensions into the body of the tumor. The surrounding tissues were not invaded and could always be removed without difficulty.

The surfaces of the tumors in contact with the spongiosa were fuzzy because of the extensions which had entered the cancelli before the walls had been absorbed. If any spicules of bone remained attached to these surfaces, as they probably did, they were so small that they were not noticed with the unaided eye. The edges of the bony defects were quite regular and the spongiosa showed slight sclerosis in only a few instances.

The cut surfaces of the fixed divided tumors looked grayish and the middle portion usually somewhat darker. Christian (1907, *b*) quotes Wright's autopsy notes to the effect that the tumors of his case were moderately firm, whitish and semitranslucent. Small openings, which undoubtedly were the cross-sections of bloodvessels, were fairly numerous. The bounding periosteum was always definitely delimited. While there were some gross differences the tumors were nevertheless remarkably uniform in appearance and structure.

Since the body had been preserved only in the usual routine way, and especially since the dissection was not completed until over two years after death, only a partial histological report is possible. Nevertheless, the things that remain throw some interesting side-lights on the disease.

The first thing to attract my attention was that the degenerative changes in the tumors apparently were not entirely the result of the usual postmortem changes. This, to be sure, was only an inference drawn from my experience with material from other cadavers and with other material studied, with a view of determining the degree and the order of postmortem changes in unpreserved material. Yet that the inference is probably correct seems to be indicated by several of the reports on myelomata found in the literature. This is true of the case of Bender in which portions of tumors from the vertebra, as judged by the illustrations, seem particularly degenerate. Bender also stated that the osteoclasts

and other cells showed signs of degeneration. Some of the cells in one of the photographs accompanying Wright's (1900) article also suggest that degeneration was present in them, and the same is true of some illustrations given by Hoffmann (1904) of his case. There are cells in all these illustrations which look as if they were dead or dying.

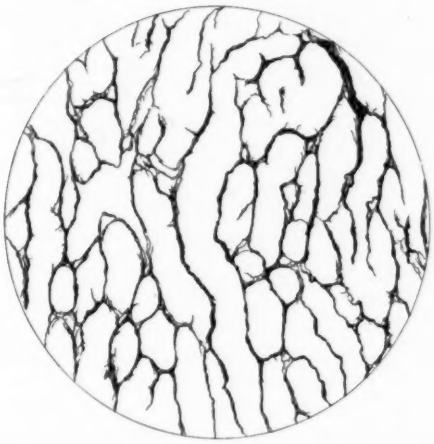

FIG. 18.—Appearance of the finer stroma. Magnification, 375.

FIG. 19.—Appearance of the denser stroma. Magnification, 375.

The stroma varied greatly in different portions of some tumors, as shown in Figs. 18 and 19. In some small areas only the very

finest, wide-meshed reticulum was present, the meshes of which were completely filled and obscured by closely packed degenerated cells. Hemorrhagic areas were present in some of them, and in

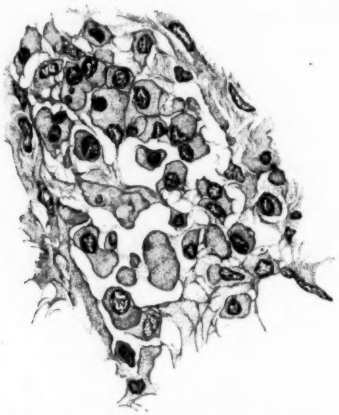

FIG. 20.—A group of cells from the better preserved portion of one of the tumors. Magnification, 750.

these the erythrocytes were quite well preserved and not infrequently completely filled the meshes of the stroma. The par-

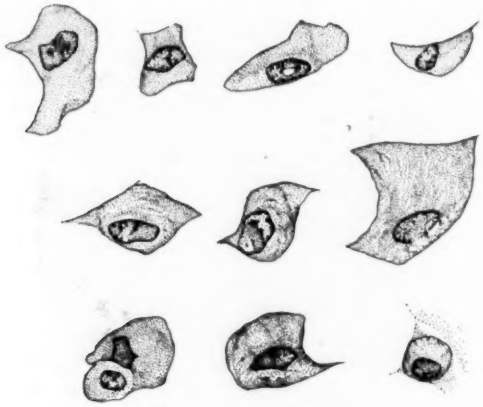

FIG. 21.—Selected well-preserved tumor cells. Magnification, 750.

enchyma also varied in different portions of the tumors, and it is evident from the close proximity of the remaining nuclei that the prevailing type of cell in some areas was not specially large. Their

size suggested lymphoid rather than myeloid cells. Fig. 20 is an oil-immersion drawing of one of the better preserved portions containing larger cells. Here the cells, although ill-preserved, are larger and quite like those shown in the illustrations of various investigators. In Fig. 21 a group of selected, quite well-preserved cells are represented under high magnification. Although these cells remind one more of myelocytes it would be idle to try to draw any conclusion from this material as to their origin.

The most interesting thing in the histological picture was the appearance presented at the line of contact between the tumor and the bone. Some of the trabeculæ of the spongiosa merely looked gnawed off, presenting a ragged surface, with numerous excavations, which looked quite comparable to Howship's lacunæ. Menne (1906) also mentions a many-notched appearance of the bony margins in places. In many instances these excavations were completely empty, but in others they were bordered by a row or rows of cells of the size of osteoblasts. The entire absence of osteoclasts, except an isolated specimen here or there, was very evident. The absence of osteoclasts was emphasized also by Borst, who stated that myeloplaxes are usually absent in multiple myelomata. Bender also found osteoclasts very rare in a case of multiple myeloma but exceedingly numerous in a case of lymphosarcoma. Bender accounted for the fewness of osteoclasts in myeloma by assuming that they degenerate or are formed into marrow cells, and mentions the fact that many multinucleated cells were present in Wieland's case, in which they were supposed to have been derived from the tumor cells. Menne also found osteoclasts frequently present in the lacunæ, as did Abrikossoff (1903), but Adami (1910) states that in pure cases there is no evergrowth of myeloplaxes. It is not at all improbable that the differences noted in regard to the osteoclasts and also in other respects are partly due to the fact that, as emphasized by several investigators, various different things are still included under the term myeloma. Then, too, it is not unlikely that age may not be wholly without influence, although the disease is one of maturity. This is especially likely in regard to the presence of a protective reaction on the part of the bones. This might well be less in such an old individual as the present case.

The good healing of all the fractures stands in marked contrast to the slight reaction at the site of the tumors and the little callus present at the place of fractures. It is difficult also to see why so little sclerosis is evident in the spongiosa in contact with the tumor itself, especially when, as is evidently the case, the process of bone destruction is a very gradual one. That this absorption is due to pressure alone, as suggested by Bender, hardly seems probable for various reasons, but particularly because several of the lesions in this case show quite conclusively that the disease may also attack a bone from without. Then, too, if pressure were the only factor

one should not expect such symmetrically shaped tumors and defects, for the resistance of the bone surely is not uniform in all directions. This is especially true when the compacta is reached. Yet even when it is reached the defect still remains quite symmetrical in form and the progress of absorption progresses about equally in all directions.

If my interpretation of several superficial defects on the compacta is correct then it would seem to follow that the disease is metastatic, at least so far as the skeleton is concerned, or that the osteoblasts may become or give rise to tumor cells.

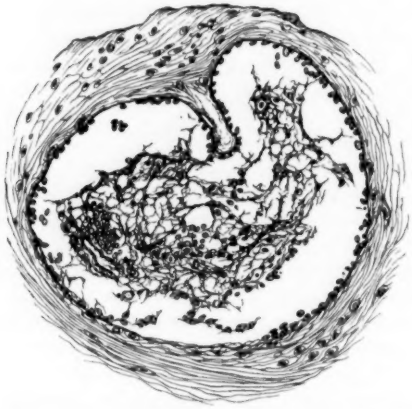

FIG. 22.—An enlarged Haversian canal lined by a layer of osteoblast-like cells. Magnification, 215.

That the process of absorption is not limited to the external surfaces of the bony area, which is directly involved, is suggested by such appearances as that shown in Fig. 22. Abrikossoff (1903) also spoke of areas which made him think of halisteresis, areas in which there was a "decalcification of the trabeculæ of the spongiosa and metaplasia of the latter into connective tissue." Bombhard, on the other hand, spoke of occasionally noticing a reaction around the tumor forming an osteoid zone. Fig. 22 shows a much-enlarged Haversian canal which contains some marrow and which is lined with a layer of cells which remind one of osteoblasts. Bender also spoke of cells lying in rows and extending into the bone. Although osteoclasts are nowhere to be seen, one can scarcely doubt that the bone absorption has been considerable here. The regularly disposed cells might also include bone corpuscles liberated by the absorption. As shown in Fig. 22 the bone corpuscles seem to be particularly numerous—in fact, increased in numbers—in some areas in the surrounding bone. In some places on the external

surface of the affected bone these cells lie in some depth, as shown in Fig. 23, where osteoclasts are again absent. In Fig. 24 a portion

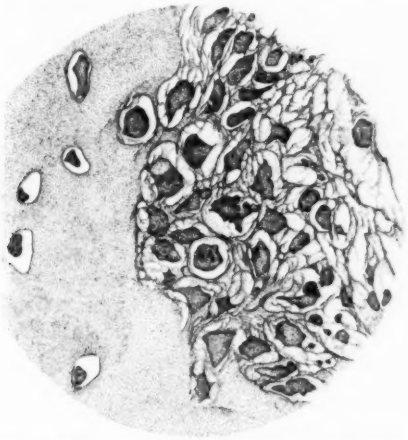

FIG. 23.—A portion of the margin of a bony trabeculum undergoing absorption. Magnification, 410.

of a trabeculum is shown at a point where it is being divided by the activity of the tumor cells. The opposed surfaces of the attached

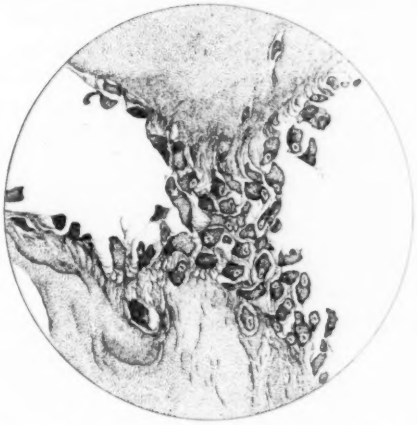

FIG. 24.—A similar region at a place where a trabeculum is being divided. Magnification, 410.

bone look fringed and the same kind of cells are again seen both within the margins and about the bone.

These appearances as well as the character of the interior of the tumors seem to suggest that the interior of the latter is largely inert. The line of action seems to be at the periphery, but only at that portion which comes into contact with bone. The absorptive agent seems to be incapable of resorbing cartilage or periosteum.

The condition of myeloma is of special interest in the light it throws on the function of osteoclasts in bone absorption. Here we certainly have a very active absorption—in fact, a process which unboubtedly is malignant even if non-metastatic to other tissues than bone, occurring practically wholly without the intervention of osteoclasts.

A fibroid structure was revealed extremely well in some areas in the neighborhood of the tumors in the costal cartilages. These areas suggested a fibrillary nature of the cartilage as maintained by several investigators rather than the formation of new osteoid areas.

A number of samples of bone and other tissues were taken for analysis, the results of which are shown in the following tabular statement. These were dried to constant weight at 100° C., and the bone samples were extracted with anhydrous ether to remove fat. Weighed portions were then ignited in platinum dishes at low redness to constant weight, yielding data from which the loss on ignition, reported as organic matter and ash, were determined. Calcium was estimated by the method of McCrudden. Phosphoric acid was precipitated as ammonium phosphomolybdate, which was filtered off, dissolved in acid, precipitated with magnesia mixture and finally estimated gravimetrically as magnesium pyrophosphate:

The following samples were analyzed:

No. 221. Ribs, clear sections, not adjacent to tumors.
No. 223. Ribs, tumor-containing sections, with tumors removed.
No. 224. Ribs, tumor-containing sections, tumors not removed.
No. 227. Skull, tumor-containing sections, tumors removed.
No. 226. Radius, section of bone not adjacent to tumors.
No. 230. Tumors from rib sample No. 223.
No. 231. Tumors from skull sample No. 227.
No. 222. Great pectoral muscle.
No. 220. Right biceps.
No. 225. Parietal pleura, calcified area.

CHEMICAL COMPOSITION OF SELECTED SPECIMENS.

No.	Sample.	Organic matter, per cent.	Ash, per cent.	CaO, per cent.	CaO per cent. of ash.	P_2O_5, per cent.	P_2O_5 per cent. of ash.
221	Ribs	37.85	62.15	32.74	52.68	24.41	39.27
223	Ribs	45.86	54.14	28.78	53.15	20.92	38.64
224	Ribs	51.85	48.15	25.75	53.48	18.85	39.15
227	Skull	32.79	67.21	35.75	53.19	25.53	37.98
226	Radius	36.36	63.64	34.11	53.60	24.51	38.51
230	Tumors	89.81	10.19	3.95	38.76	3.27	32.09
231	Tumors	89.37	10.63	3.72	35.00	3.29	30.95
222	Muscle	97.64	2.36	0.70	29.66		
220	Muscle	98.38	1.62	0.61	37.65		
225	Pleura	64.87	35.13	17.01	48.67		

Hoppe-Seyler[2] first called attention to a fairly constant relation between the calcium and the phosphoric acid content of bone which did not show considerable variations even when the proportion of other substances varied materially. This proportion was near to that in which these are present in the mineral apatite, the formula of which is $CaCO_3.3Ca_3(PO_4)_2$. Levy[3] has found that this relation is maintained fairly closely in osteomalacia, his analytical results ranging from 527 to 574 parts PO_4 to 400 parts of Ca instead of a theoretical ratio of 570 to 400. The above bone samples give the following values on this basis:

Number.	Sample.	Ca.	PO_4.	10Ca : 6 PO_4 (400 : 570)
221	Ribs	23.40	32.66	400:558
223	Ribs	20.56	28.00	400:544
224	Ribs	18.40	25.22	400:548
227	Skull	25.53	34.16	400:535
226	Radius	24.39	32.79	400:537

These figures show a somewhat higher value for calcium and a lower value for phosphoric acid than the average figure for the normal human adult organism, but the difference is not great enough to have any particular significance. The percentage of inorganic constituents in all samples is low. The percentages of organic matter and ash show abnormal variations, with very low figures for the ash content, especially in the tumored rib sections.

Attention should be called to the very high percentage of calcium in the calcified area of the parietal pleura as well as to the very large amount in the muscle samples.

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[2] Arch. f. path. Anat., 1862, xxiv, 13. Lehrbuch der physiol. Chem., 1877, 104.

[3] Ztschr. f. physiol. Chem., 1894, xix, 238–270.

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MENINGITIS IN THE NEWBORN AND IN EARLY INFANCY.

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Introduction. Although meningitis is a disease quite common in childhood, it is one that is exceedingly rare during the early months of infancy. In making a rather careful review of the literature, I have been able to find only 39 cases reported in infants under three months old. Of these 39 cases, 19, including the case to be reported in this paper, were in the newborn.

The etiology in these cases was interesting, especially in the newborn. Of the 19 cases in this series, 7 were caused by the same type of bacillus which was isolated in pure culture from the present case, the Bacillus coli; 6 cases were caused by the staphylococcus and streptococcus. The infection of most of these was through a spina bifida, a condition present in nearly every one of this group. Two were caused by the pneumococcus and one each by meningococcus, Bacillus mucosus capsulatus, Bacillus lactis aërogenes and Bacillus pyocyaneus.

The relatively frequent occurrence of colimeningitis among the newborn is emphasized by Allard,[1] who states that this is the commonest form encountered. He believes that infants and children are specially predisposed to meningeal diseases. Moll[2] claims that colimeningitis in nurslings is generally consequent to colicystitis. This statement is not substantiated by a careful study of the literature. Indeed, it is definitely stated in several cases that examination of the urine showed nothing abnormal and that the specimens were sterile.

Holt[3] reviews a series of 300 of his own cases of meningitis in infants up to three years old. The Bacillus tuberculosis was responsible for 70 per cent. of this series, but only 1 per cent. was in infants under three months old. He shows by statistics from the city of New York and from his own practice that if epidemic meningitis

[1] Die Lumbalpunktion. Ergebnisse der inneren Medizin und Kinderheilk., 1909, Bd. iii, S. 100.
[2] Prager med. Wchnschr., 1907.
[3] Observations on 300 Cases of Acute Meningitis in Infants and Young Children, Am. Jour. Dis. of Child., 1911, i, 26.

be excluded, from 55 per cent. to 70 per cent. of all cases of meningitis in infants and young children are tuberculous in origin. Practically no cases of colimeningitis are reported in children over six months old. Smith[4] states that 75 per cent. of all cases of tuberculous meningitis in children occur before the fifth year. The largest number occur during the second year. He also mentions the fact that, exclusive of epidemic meningitis, 70 per cent. of all meningeal infections are tuberculous. These statistics, together with the tables to follow, help to emphasize through contrast the variations in susceptibility of infants of different age periods to the various infecting agents.

Review of the Literature. The earliest cases of meningitis which I found in the literature were reported by Sherer (1895[5]). He reported 3 cases in infants from eight days to six weeks old. One of these cases was a weak, jaundiced infant nine days old, suffering from vomiting, diarrhea and rapid loss in weight. It died, with definite meningeal symptoms, nine days later. At the autopsy considerable pus was found covering the convexity and the base of the brain. A bilateral suppurative otitis media was present. The bacteriological report was colimeningitis. Two other cases of infants, eight days and six weeks old respectively, occurred in the same hospital during a period of a little over a year. All presented the same type of lesions: fibrinopurulent colimeningitis and bilateral otitis media. Sherer considers his 3 cases as a small epidemic, due to overcrowding in the hospital. He thinks that the infection originated through the contaminated water used in bathing the infants. The infected material, lodging in the external ear, started the otitis media. From this location the infection spread to the brain. It is also possible for the infection to have gained entrance through the mouth and from there to have been carried through the lymphatics or, more probably, through the Eustachian tubes to the middle ears and then to the brain.

Hinsdale(1899[6]) describes a case of meningitis in an infant, three days old, caused by Bacillus coli immobile. The mother had suffered with an acute metritis following a miscarriage two years previously. During and after the expulsion of the placenta, large quantities of pus escaped from the uterus. The infant began losing in weight and on the third day the emaciation was quite marked. Nystagmus and retraction of the head were present from birth. Convulsions appeared on the fourth day. The umbilical cord had a fetid odor. The infant would not nurse and died on the thirteenth day. At autopsy an abscess was present in the left frontal lobe of the brain

[4] Meningitis in Infancy, Illinois Med. Jour., 1913, No. 3, xxiii, 299.

[5] Ein Beitrag zur Aetologie der Leptomeningitis Purulenta bei Säuglingen, Jahrbuch f. Kinderheilk., 1895, Bd. xxxix, S. 1.

[6] Purulent Encephalitis and Cerebral Abscess in the Newborn Due to Infection from the Umbilicus, Am. Jour. Med. Sc., 1899, cxviii, 280.

in addition to the exudate on the surface. There was an induration of the abdominal wall around the navel. The infection in this case probably arose from the previous endometritis. The process extended through the placenta to the fetus.

Scheib(1900[7]) cites a case of an eight-day-old infant who died with the diagnosis of general debility. At autopsy a purulent meningitis was found, caused by the Bacillus lactis aërogenes. This organism is considered a frequent cause of meningitis in infancy, but this case is the only one I found recorded.

Goldreich(1902[8]) cites an interesting case of antenatal infection with Bacillus coli. Convulsions, together with cyanosis, jaundice, diarrhea, rigidity of neck and irregular respirations, appeared in the infant on the first day of its life. It died on the second day. The principal finding at autopsy was a fibrinopurulent meningitis. A purulent pleuritis and acute bronchitis were also present. It is hardly conceivable that the infection in this case did not happen until after birth. The author suggests that the bacteria might have gained entrance into the uterus during labor, which in this case lasted three days. On the second day the amniotic sac ruptured, opening an avenue for the entrance of germs. Then the fetus aspirated some of the contaminated fluid through premature respirations. From the lungs the infection was carried to the brain by the blood. Such a presumption helps to explain the bronchitis and pleuritis as well as the meningitis found at autopsy. This is probably the youngest case of suppurative meningitis reported in the literature.

Benfey (1907[9]) cites a case of Bacillus pyocyaneus meningitis for the purpose of proving the pathogenicity of this organism. He reports a case of a seven-day-old infant who developed meningeal symptoms and died on the eighth day. The navel was distinctly inflamed and the author believes that it was the portal of infection. At autopsy a pure culture of Bacillus pyocyaneus was recovered both from the purulent exudate on the brain and from the blood.

Noeggerath's case (1907[10]) was in a female infant, sixteen days old, who was well up to the eleventh day. She then developed abdominal cramps and symptoms of meningitis. A purulent exudate was present on the umbilicus. In the eighth week a double otitis media appeared. An organism was isolated which seemed to correspond to Bacillus coli, but had properties also of Bacillus lactis aërogenes. It was encapsulated and quite motile. It was identified as Bacillus coli immobilis capsulatus. Stern[11] and Conradi and

[7] Prager medizin. Wchnschr., 1900, S. 169.

[8] Meningitis beim Neugebornen, Jahrbuch f. Kinderheilk., 1902, Bd. lvi, S. 808.

[9] Ueber Pyozyaneussepsis, Med. Klinik, 1907, Nr. 40, S. 1199.

[10] Bacillus Coli Immobilis Capsulatus bei Einem Falle von Eitriger Meningitis Cerebrospinalis, München. med. Wchnschr., 1907, Nr. 13, Bd. liv, S. 617.

[11] Zur Kenntnis der Pathogenen Wirkung des Koli beim Menschen, Deutsch. med. Wchnschr., 1893.

Bierast[12] speak of the many variations that may occur in the Bacillus coli when it becomes pathogenic. Noeggerath thought that the infection in this case was either through the navel or through the intestinal tract. An argument against the navel route was the microscopic finding of the umbilical vessels, which showed no evidences of any inflammation.

Holt (1911[13]) reports a series of 300 cases of meningitis in children under three years old, but from the data given I could classify only 11 of them as occurring in infants under three months old. Of these 11, 3 cases (a very large percentage) were due to Bacillus tuberculosis; 6 cases to staphylococcus and streptococcus and only 1 case to Bacillus coli. The last case presented meningeal symptoms only. It became sick when four weeks old and died in the sixth week. A pure growth of Bacillus coli was obtained from the purulent fluid removed from the spinal canal. The author cites an additional case of colimeningitis from his private practice. This was in a four-weeks-old infant who had previously suffered from a colon infection of the urinary tract.

Pearson's case (1912[14]) was in a female infant, three months old. At autopsy the Bacillus coli communis was isolated from the spinal fluid and from the purulent exudate enveloping the brain and filling the ventricles. There was also an acute suppurative otitis media present. The author holds this latter condition responsible for the meningitis.

Smith and Woodforde(1912[15]) report a case of colimeningitis in an infant somewhat older than the usual incidence of this infection. Their patient was five months old. The organisms isolated were very motile. The disease at first responded to autogenous vaccine therapy, but later the patient died. The urine in this case was sterile. The authors consider the meningitis as a primary infection.

A case of meningitis caused by the Bacillus mucosus capsulatus is reported by Bonhoff and Esch (1912[16]). The infant was born in asphyxia. A catheter was inserted into its trachea to initiate respiration. Small quantities of amniotic fluid and mucus escaped from the mouth when the infant started breathing. The first four days it was restless, whimpered a great deal and did not nurse well. Clonic contractions appeared in the face muscles and in the back muscles on the sixth day. The development of emaciation was rapid. Spinal fluid was removed and examined but no cultures were made. Death occurred on the fourteenth day. At autopsy

[12] Kolle-Wassermann: Handbuch der Pathogenen Mikroorganismen, 2 Auflage, Bd. vi, S. 483.

[13] Loc. cit.

[14] A Case of Meningitis in Which the Bacillus Coli Communis was Obtained from the Cerebrospinal Fluid, Lancet, London, 1912, clxxxii, 722.

[15] Two Unusual Forms of Meningitis Occurring in Infancy, Lancet, London, 1913, clxxxiii, 236.

[16] Ueber Einem Fall von Meningitis purulenta beim Neugebornen, infolge rechtseitiger Mittleohrentzündung, Ztschr. f. Geburtsh. u. Gynäk., 1912, Bd. lxx, S. 886.

there was pus present over the brain and in the right middle and internal ear. Culture from the pus on the brain and from the middle ear showed a pure growth of Friedländer's bacillus.

Lyall (1913[17]) gives a detailed report of a case of typhoid meningitis in a female infant four months old. She died six weeks after the onset of the symptoms. The postmortem examination showed a diffuse purulent meningitis with no lesions present characteristic of typhoid fever. The author thinks that the infection in this case took place through the intestinal tract.

Giese (1913[18]) reports the only case of influenzal meningitis in a young infant found in the literature, though some authors state that this type of infection is not uncommon.

Von Reus (1914[19]) reports a case of colimeningitis in a newborn infant. The case is cited by Michael,[20] with no data given.

Hermann (1915[21]) reports what he considers the only case of pneumococcic meningitis in the newborn. When thirteen days old the infant was taken sick. It died at the age of seventeen days. No meningeal symptoms were present at any time, yet the autopsy revealed a purulent meningitis as the only lesion present. Culture of the pus gave a pure growth of pneumococci. The author discusses the possible portals of infection. The umbilical route he considers rare. Premature respiration of the infant during difficult labor, he believes, may result in the aspiration of contaminated liquor amnii and thus start the infection. Infection may also occur through an injury to the skull during delivery. After birth the mouth, nose, throat, *intestinal tract*, ears, eyes, umbilicus or urinary tract may be the portals of entry. He states that the contaminated water of the bath-tub is a frequent source of infection, and thus agrees with Noeggerath[22] and Sherer.[23]

Michael (1916[24]) recovered the Bacillus coli communis from the spinal fluid of a five-months-old infant. It died two weeks later. The organism was very motile. The exudate was described as a thick brownish pus, a characteristic mentioned by a number of authors.

A valuable contribution to meningitis in infants is made by Koplik (1916[25]). He reports, with some detail, his findings in 12 of his own cases. Four of his cases were due to streptococcus; 3 to

[17] Meningitis in an Infant Caused by the Typhoid Bacillus, Jour. Med. Res., 1913, No. 4, xxvii, 457.

[18] Ugeskrift for Laeger, Copenhagen, 1913, No. 16 (Abs. in Jour. Am. Med. Assn.).

[19] Cited by Michael (20).

[20] Recovery of the Colon Bacillus from the Spinal Fluid of a Five-months-old Infant, Arch. of Ped., 1916, xxxiii, 280.

[21] Meningitis in the Newborn, with Report of a Case, Arch. of Ped., 1915, No. 8, xxxii, 583.

[22] Loc. cit.

[23] Loc. cit.

[24] Loc. cit.

[25] Meningitis of the Newborn and in Infants under Three Months of Age, Arch. of Ped., 1916, xxxiii, 481.

pneumococcus; 4 to meningococcus; 1 to Bacillus coli. One case of the streptococcus, 1 of the meningococcus and the case of Bacillus coli meningitis showed symptoms within a few days after birth.

Case No.	Author.	Year.	Age.	Type of bacterium.	Probable portal of entry.
1	Sherer	1895	Newborn	B. coli	Otitis media.
2	Sherer	1895	Newborn	B. coli	Otitis media.
3	Sherer	1895	6 weeks	B. coli	Otitis media.
4	Hinsdale	1899	Newborn	B. coli	Placenta.
5	Scheib	1900	Newborn	B. lactis aërogenes	
6	Goldreich	1902	Newborn	B. coli	Lungs.
7	Benfey	1907	Newborn	B. pyocyaneus	Umbilicus.
8	Noeggerath	1907	16 days	B. coli	Intestinal.
9	Holt	1911	3 months	B. tuberculosis	
10	Holt	1911	3 months	B. tuberculosis	
11	Holt	1911	3 months	B. tuberculosis	
12	Holt	1911	Newborn	Staphylococcus and streptococcus	Spina bifida.
13	Holt	1911	Newborn	Staphylococcus and streptococcus	Spina bifida.
14	Holt	1911	Newborn	Staphylococcus and streptococcus	Spina bifida.
15	Holt	1911	Newborn	Staphylococcus and streptococcus	Spina bifida.
16	Holt	1911	Newborn	Staphylococcus and streptococcus	
17	Holt	1911	Newborn	Staphylococcus and streptococcus	
18	Holt	1911	4 weeks	B. coli	
19	Holt	1911	4 weeks	B. coli	
20	Pearson	1912	3 months	B. coli	Suppurative otitis media.
21	Smith and Woodforde	1912	5 months	B. coli	Hematogenous.
22	Bonhoff and Esch	1912	Newborn	B. mucosus capsulatus	Eustachian tube.
23	Lyall	1913	4 months	B. typhosus	Intestinal.
24	Giese	1913	?	B. influenzæ	
25	v. Reus	1914	Newborn	B. coli	Hematogenous.
26	Herrman	1915	Newborn	Pneumococcus	
27	Michael	1916	5 months	B. coli	Hematogenous.
28	Koplik	1916	Newborn	Meningococcus	
29	Koplik	1916	6 weeks	Meningococcus	
30	Koplik	1916	3 months	Meningococcus	
31	Koplik	1916	3 months	Meningococcus	
32	Koplik	1916	Newborn	B. coli	Circumcision.
33	Koplik	1916	6 weeks	Streptococcus	
34	Koplik	1916	7 weeks	Streptococcus	
35	Koplik	1916	3 months	Streptococcus	
36	Koplik	1916	6 weeks	Streptococcus	
37	Koplik	1916	Newborn	Pneumococcus	
38	Koplik	1916	8 weeks	Pneumococcus	
39	Koplik	1916	3 months	Pneumococcus	
40	White	1917	29 days	Meningococcus	
41	White	1917	39 days	Catarrhalis (?)	
42	Barron	1917	Newborn	B. coli	Mouth (?)

The above table gives in tabulated form all the cases within the ages under discussion which were found in the literature.

The last-mentioned case occurred in a male infant who was circumcised on the eighth day. Three days later a colipyelitis set in, which was followed a week afterward by colimeningitis. The patient died at the age of sixteen months from asthenia and necrosis of both eyes, associated with marked hydrocephalus. The author emphasizes the fact that infections may occur through abrasions in the buccal mucous membranes produced by the accoucheur.

White (1917[26]) reports 2 cases in infants twenty-nine and thirty-nine days old respectively. The meningitis in the first case was caused by the meningococcus. From the second case an organism was isolated which was thought to be the Micrococcus catarrhalis. However, this diagnosis is questionable.

The following table gives the classification of the above forty-two cases according to ages:

Newborn	19
Two weeks to one month	4
One month to two months	7
Two months to three months	8
Three months to five months	3
Exact age uncertain	1
Total	42

Subtracting the 3 cases of three to five months old leaves 39 cases under three months.

The following table shows the classification of the 19 newborn cases according to etiology:

Bacillus coli	7
Streptococcus and staphylococcus	6
Pneumococcus	2
Meningococcus	1
Bacillus mucosus capsulatus	1
Bacillus lactis aërogenes	1
Bacillus pyocyaneus	1
Total	19

The following table shows the classification of the 42 cases according to etiology:

Bacillus coli	14
Streptococcus and staphylococcus	10
Meningococcus	5
Pneumococcus	4
Tuberculosis	3
Bacillus mucosus capsulatus	1
Bacillus influenzæ	1
Bacillus typhosus	1
Bacillus lactis aërogenes	1
Bacillus pyocyaneus	1
Bacillus catarrhalis (?)	1
Total	42

[26] Case Reports of Infectious Meningitis Occurring in Babies Twenty-nine and Thirty-nine Days Old Respectively, Arch. of Ped., 1917, xxxiv, 372.

The above shows that the Bacillus coli causes practically 33 per cent. of all cases of meningitis in infants under three months. (Three cases in the table are over three months old.) Of this 33 per cent. (14 cases), one-half (7 cases) occurred in the newborn. This is strongly in contrast with the etiology of non-epidemic meningitis in infants of the second year of life, as is well brought out by the statistics of Holt[27] and others.

Case Report.—My own case is that of a male infant, eleven days old, who was delivered in breech presentation. The mother is a hard-working woman, aged forty-four years, who has had eight pregnancies, including the last one. Six children are living and well. During the latter months of the last pregnancy the mother experienced pain in the epigastrium which was of the character of real labor pains during the last two weeks before delivery. She noticed that her abdomen was excessively enlarged. The childbirth, she thinks, was about one month premature. The confinement was in the home, with practically no medical attention up to the second stage of labor. That there was a condition of hydramnios became evident when, during the second stage of labor, more than 1 gallon of amniotic fluid escaped. The delivery of the head was assisted by the insertion of a finger into the mouth of the fetus and then using a moderate amount of traction. The infant was cyanotic at birth, and it required considerable effort to initiate respiration.

The infant had a whimpering cry and at no time nursed well. A slight right-sided paralysis made its appearance on the third day. The right hand appeared puffy and edematous. On the tenth day there was a bilateral swelling of the eyelids. Several slight convulsions were noticed on the morning of the eleventh day. The lips turned cyanotic. The child died on the same day.

Autopsy Protocol. I performed the autopsy fourteen hours postmortem. I shall indicate only the important findings.

The body is fairly well developed, somewhat undernourished. The skin and conjunctivæ are slightly jaundiced. There is a depression 3 mm. deep over the left parietal eminence. This measures 2 x 4 cm. The skin over it is not abraded. The umbilicus has dropped off; the navel is dry and appears healthy. The right lung shows petechial hemorrhages beneath the pleura and in other portions of the parenchyma. The gastro-intestinal tract shows no lesions and appears entirely normal. Both adrenals are large, distended and of a bluish-red color. On section, large hemorrhages are found involving the medullæ, which extend more than half the distance into the cortices.

In removing the scalp no lesions are visible over the depressed area, nor is there any evidence of injury to the brain after the calvarium and dura mater are removed. The brain is found covered with a layer of brownish fibrinopurulent exudate. This is most

[27] Loc. cit.

marked over the left parietal region. The base of the skull and middle ears are free from lesions.

Smears from the exudate show disintegrated pus cells and immense numbers of extra- and intracellular Gram-negative, short, plump bacilli.

Microscopically the lungs show small areas of congestion and hemorrhage. The heart and spleen are normal. The liver shows a mild fatty metamorphosis. Many of the cells are swollen and their nuclei are vesicular. The adrenals show hemorrhages into the medullæ, with only an occasional parenchymal cell visible. The inner portions of the cortices are torn; the cords of cortical cells are separated by areas of hemorrhage. The kidneys show intense congestion of the glomerular tufts. The thymus shows moderate "accidental" involution.

The brain parenchyma is normal. The pial vessels are greatly dilated. The arachnoid space is filled with an exudate of fibrin, a few red blood cells and masses of leukocytes, nearly all of which are polymorphonuclears. In some areas the exudate consists almost wholly of fibrin and red blood cells.

Bacteriological Studies. Cultures were made from the exudate and from the heart's blood. This, together with the animal inoculations, was performed by Dr. Arthur T. Henrici. I am indebted to him for the data of the bacteriological studies.

The report states that the smears from the pus show a very short, Gram-negative coccobacillus. Some of the bacilli stain more deeply at the poles than in the middle and give the appearance of diplococci.

The cultures from the heart's blood showed no growth. The first cultures from the pus showed a short, slender bacillus, with a few coccoid and irregular forms. Some forms possessed club-shaped extremities. The subcultures and all subsequent cultures gave a fairly uniform bacillus typical of Bacillus coli. In hanging-drop preparations all of the cultures showed a very active, typhoid-like motility.

The cultural characteristics of this organism on the different media are as follows:

Agar: spreading, moist, grayish growth.

Broth: uniform turbidity.

Gelatin stab: filiform growth; no liquefaction.

Litmus milk: first culture acid in four days; no coagulation. Subsequent cultures: acid in two days; coagulation in seven days; very little whey expressed.

Peptone solution: indol in four days.

Sugars: dextrose, acid and gas in twenty-four hours.
maltose, acid and gas in twenty-four hours.
mannite, acid and gas in twenty-four hours.
lactose, acid in forty-eight hours; gas in four days.
saccharose, no acid and no gas.

(Gas formula = $\frac{CO_2}{H_2} = \frac{1}{2}$.)

In all the subcultures the lactose fermented a day or two later than did the other sugars.

From the above it will be seen that the organism recovered was definitely the Bacillus coli communis, but the marked motility and the tardiness in its action on lactose at first suggested the Bacillus paratyphosus.

Inoculations into rabbits and guinea-pigs, either intravenous or intraperitoneal, killed the animals in from twelve to forty-eight hours. The organism was recovered from the blood in each case. No immunity reactions were performed.

COMMENT. Conradi and Bierast[28] speak of the variations in size, shape and motility in Bacillus coli. They also mention that some strains are slow in fermenting lactose. Actual mutations are thought to occur, and these strains are sometimes designated as Bact. coli mutabile. Most of the strains of Bacillus coli isolated from the meningitis cases here reported were actively motile.

The susceptibility of infants to Bacillus coli infections has long been noted. Beitzke[29] states that Bacillus coli is the principal causative agent of pyelitis, pyelocystitis and pyelonephritis. It also sometimes produces intestinal diseases, general sepsis and meningitis. Yet in the adult this organism is almost entirely a saprophyte, being a constant inhabitant of the intestinal tract, and rarely does it become pathogenic. But since the protective powers of the infant are very feeble the bacillus occasionally gets a foothold and becomes pathogenic. Halban and Landsteiner state that infants possess a very low capacity for the manufacture of protective substances. Artificially-fed infants are said to be even more susceptible to infections than breast-fed ones, because the mother's milk contains immune bodies which are utilized by the infant.

La Fetra[30] does not believe that infants are born septic very often. Such instances, he thinks, are indeed rare. He also doubts that infection is common through the aspiration of contaminated liquor amnii, as claimed by Sherer[31] and others. Bonhoff and Esch,[32] on the other hand, claim that in their case the infecion was through the Eustachian tube, brought about by the aspiration of liquor amnii during premature breathing in intra-uterine life. The fluid and mucus which escaped from the mouth of the infant at the beginning of respiration certainly warrants such a contention. The introduction of the catheter may also have carried the infection. Aschoff[33] has found in his careful studies that the passage of liquor amnii up the Eustachian tubes during premature respiration is fairly common. He, however, believes that the inflammation resulting from

[28] Loc. cit.
[29] In Bruning und Schwalbe's Handbuch der Allgemeine Pathologie, Bd. i, S. 252.
[30] Accidents and Diseases of Early Weeks, Arch. of Ped., 1916, xxxiii, 401.
[31] Loc. cit.
[32] Loc. cit.
[33] Ztschr. f. Ohrenheilk., Bd. xxxi, S. 295.

it is not due to infection introduced but only to the fluid itself acting as a foreign body. Rasch[34] studied the postmortem findings relative to middle-ear diseases in 82 autopsies on infants up to two years old. He found that fully 75 per cent. had either unilateral or bilateral middle-ear involvement, many cases of which were purulent in character. Several cases had meningitis associated with it. Such a finding strongly suggests that meningitis must be not infrequently secondary to middle-ear infections. If this finding be correlated with the finding of Aschoff,[35] that there is a *locus minoris resistentiæ* in the middle ears due to the presence of aspirated amniotic fluid, then the sequence of events leading up to many cases of meningitis becomes almost self-evident.

But La Fetra[36] believes that the umbilicus is the most important route. Also that the skin and mucous membranes are frequent avenues because these tissues are comparatively undeveloped at birth. The intestinal mucous membrane, for example, is undoubtedly pervious to bacterial invasion without any evident lesions. The cases of bovine tuberculosis in infants and young children without intestinal tuberculosis certainly corroborate such a concept. As to the mucous membrane of the mouth, as a portal of entry, one can get little definite proof. In my case I believe that the infection occurred through the introduction of the accoucheur's finger during delivery. Koplik[37] calls attention to this method of introducing infection. A woman who has not been properly prepared for delivery will have the vulva more or less contaminated with fecal material. The introduction of a finger into the mouth of the infant in the process of delivery might create just the proper conditions for infection: the introduction of the infectious agent and the abrasion of the covering epithelium, the mucous membrane.

There is some evidence in favor of the idea that the external auditory canal is also an important avenue for infection in the infant. Rasch[38] believes that of the two avenues of infection of the middle ear, that of the Eustachian tube and of the external auditory canal, the latter is the more important one.

General Conclusions. 1. Meningitis in the newborn and in early infancy is a rare disease.

2. The important place that the Bacillus tuberculosis holds in the meningitis of later infancy the Bacillus coli occupies in the early months of infant life.

3. Pathogenic strains of Bacillus coli may show marked variations in form, in rates of fermentation and in motility.

4. The avenues of infection of the newborn have not been definitely established. Nevertheless, infection through the mouth

[34] Ueber die Häuflichkeit und Bedeutung von Mittleohrentzünd bei Kleinen Kranken Kindern, Jahrbuch f. Kinderkeilk., 1894, Bd. xxxvii, S. 319.

[35] Loc. cit.

[36] Loc. cit.

[37] Loc. cit.

[38] Loc. cit.

by means of fingers or instruments of the accoucheur must always be borne in mind and proper precautions taken accordingly.

5. It is reasonable to believe that some infections occur in the bath-tub through water that has become contaminated. The portals of entry of the bacteria may be either through the external auditory canals, the mucous membrane of the mouth, the Eustachian tubes or the intestinal tract.

6. The susceptibility of infants to infection with organisms, that are otherwise only slightly pathogenic, may be explained by the feebleness of antibody production during the early months of infancy. The greater resistance of breast-fed infants over the artificially-fed ones is probably due to the compensation of the passive immunization by the breast milk for the active immunization which is still deficient.

THE PROGNOSIS OF EXOPHTHALMIC GOITRE.

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Seven years ago I read before the Schenectady County Medical Society a paper on the surgical treatment of goitre. The discussion which followed was confined largely to the question of exophthalmic goitre; it was a typical discussion such as usually follows whenever the subject of exophthalmic goitre is brought before a general medical society.

An analysis of the facts brought out in this discussion showed that every man taking part reported at least one case cured or satisfactorily improved under some form of treatment, but that no two men had used the same form of treatment and no one man had used the same form of treatment in more than one cured case.

From the facts brought out in this discussion we can draw the following conclusions:

1. A certain proportion of exophthalmic goitre cases recovered under such diverse forms of treatment that we must come inevitably to the conclusion that the disease is self-limited in some as yet not definitely determined proportion of cases.

2. Before really definite opinions can be expressed concerning the value of any particular form of treatment we must have a fairly definite conception of the life history of the disease. We must know what ultimately becomes of patients undergoing various forms of treatment or no treatment at all. The results of the various methods must be compared, and it must be determined whether or not they show results differing from those to be ordinarily expected in the natural course of the disease.

3. The fluctuations in the course of the disease as regards individual cases during short periods of time is so variable as to make conclusions based on individual or small groups of cases followed for a short period of time almost of no value whatever.

Following the above-mentioned discussion I determined to collect from the literature as much as possible of the available published data concerning the prognosis of exophthalmic goitre. This data I analyzed in two ways: (1) as regards the general conclusions arrived at by the many writers on this subject, and (2) by taking the actual case results as reported by the individual writers and reanalyzing their data in so far as it had a bearing on the questions under consideration.

For this latter part of the work a standard form, such as is used in census and actuarial investigations, was devised, showing the total number of cases of each author available for the purposes of our study, the number treated by excision, ligation, or sympathectomy, Beebe serum or simple medicinal means and the period during which the patients had been followed as under one year, from one to three years, three to five years or over, five years and the final condition—cured or satisfactorily improved, somewhat improved, not improved or dead.

Could one tabulate a sufficient amount of accurate data in this way it would be possible to chart an average or composite picture of the life history of the disease under each particular form of treatment. The accurate available data was, however, only sufficient for one to gain a general impression as to what these curves would be if we had had sufficient data to plot the complete curves.

From the literature then (1913) available my assistant, Dr. Deeds, and I were able to collect reports of end-results based on a total of 2880 cases, and eliminating duplicates when two or more writers have made use of the same clinical material, we had left 1623 cases divided as follows:

Excision of one lobe, 610
Sympathectomy, 231
Serum, 442
Medical, 330.

All of the older and much of the recent data is complicated by including as exophthalmic goitres cases exhibiting symptoms of goitre toxemia as a complication of large non-hyperplastic goitres, the so-called aplastic-toxic cases of the Mayo classification. My remarks concerning exophthalmic goitre are intended to apply to the true hyperplastic cases presenting the typical symptoms-complex of Graves's or Basedow's disease.

Basing my conclusions largely on the above-mentioned data, I believe that we can state, with reasonable certainty, that typical exophthalmic goitre of the Basedow type is in a majority of cases a

self-limited disease. Plummer, of the Mayo Clinic, states that the height of the intoxication is usually recorded during the first year. Toward the close of the second year I believe that we may expect about one-third of the cases to have so far recovered as to be able to continue at their normal occupations, while at still later periods others improve so that we may count on 60 to 70 per cent. of spontaneous recoveries after a period of five or six years. These conclusions agree with those of Hale White, who was able to trace 87 exophthalmic goitre patients who had been treated in Guy's Hospital and in his own private practice, and after a number of years found 61 of these patients cured and 21 decidedly improved, leaving only 5 of the 87 unimproved.

The medically treated cases studied by us showed a mortality of approximately 10 per cent. during the period they were under observation. Hale White found 15 deaths among 102 exophthalmic goitre patients. He compared the actual deaths with the expected deaths in healthy insured individuals of the same age for the same period of time and found the mortality among the exophthalmic cases to be only twice that of the normal death-rate for healthy persons of the same age as determined by life-insurance experience. This is not a high mortality, and in life-insurance work is equalled by many occupations and conditions not ordinarily considered to be specially dangerous.

My studies of the prognosis of exophthalmic goitre have led me very firmly to the belief that there are only two major factors in the non-operative treatment of exophthalmic goitre—namely, rest and time. Drugs and various other measures may tend to give some degrees of temporary subjective relief, but there is no proof in any of the articles so far published that the improvement noted is anything other than that to be expected in the natural course of the disease.

With the above somewhat sketchy outline of the normal prognosis of this disease it is evident that the surgeon must accomplish certain very definite results if he is to prove that surgery is to have a permanent place in the treatment of exophthalmic goitre.

At the very lowest estimate from 20,000 to 30,000 operations have been performed in this country during the past ten years for exophthalmic goitre, and yet, except for some fragmentary data as to the operative mortality and the general trend of the end-results as obtained in several clinics where very special skill has been developed in handling these cases, the medical profession is in almost complete ignorance as to the actual results obtained through this very large number of operations for exophthalmic goitre.

Similar lack of adequate end-result knowledge could be cited in many other fields of surgery. Several reasons have been assigned for this lack of knowledge, such as the difficulty of keeping track of patients and the time and labor required to ascertain and record

the results. My own end-result studies, carried out over a period of ten years, have convinced me that these excuses are mere details and that the chief reason for our present-day lack of end-result knowledge is that surgeons have not as yet devised a uniform and satisfactory system for reporting the data which they have been able to collect. Surgical literature is full of communications dealing in a general way with the subject of end-results, in which it is evident that the author is in possession of considerable data which he has finally despaired of presenting in other than the most general terms.

Some time ago I found that I had several thousand histories with end-result records extending over fairly adequate periods of time, but that whereas these records had been collected with, let us say, one unit of energy on my part, when I came to study any one group of cases it took several units of time and energy to put the data into form suitable for study and comparison. In some groups it was impossible to classify the results according to the usually attempted standards. Also, I found that no two surgeons adopted the same standards in reporting their cases, so that it was impossible to compare small groups from different sources or to combine them into larger series of greater statistical value.

The real reason for this difficulty lies in the fact that surgeons have tried to state the end-results in terms such as "cure," "improved," etc., without reference to the time element. Actually, our patients are cured, or whatever the result may be, for variable periods of time, and it is just as absurd to try to state end-results in terms ignoring the element of time as it would be to attempt to state the area of a plot of ground in terms of one dimension.

All of the major difficulties of presenting the end-results disappear if we tabulate the results in terms of the time the patients have been traced following the operation, together with their state of health for the time periods. By this method the "cured" column becomes "years cured," and the term "years" is also added to the other divisions. It is also of advantage to add the headings "years operated" and "years traced," as illustrated in the accompanying table, which shows the results of tabulating 26 exophthalmic goitre cases operated by myself.

The mortality may be recorded either as "years dead" or by simply giving the number of deaths. In the cases here reported the operative and late deaths are given in separate columns, also the expected mortality in normal individuals for the same period is indicated.

The advantages of this system of recording end-results are quite obvious. No matter how complicated the postoperative history, it can be readily subdivided and classified into the appropriate periods.

RESULTS FOLLOWING OPERATIONS FOR EXOPHTHALMIC GOITRE.

Case No.	Years op.	Years traced.	Years cured.	Years satisfactorily improved.	Years improved.	Years unimproved.	Deaths.	
							Immediate.	Late.
2	10	3	....	....	3			
3	10	10	....	....	8	1	....	1
4	9 1/12	8 10/12	7 4/12	1 6/12				
5	8 11/12	8 5/12	6 11/12	....	6/12	1		
6	8 10/12	8 10/12	7 10/12	....	1			
7	8 5/12	8 2/12	6 2/12	2				
8	7 11/12	7 3/12	6 9/12	6/12				
9	7 3/12	1	....	....	6/12	6/12		
12	6 3/12	6 3/12	5	1 3/12				
13	6 6/12	5 9/12	5 1/12	8/12				
16	5 10/12	9/12	....	9/12				
18	5 3/12	4 9/12	....	....	....	....	1	
19	5 6/12	5 6/12	....	1 6/12	4			
21	5 4/12	5 4/12	4 4/12	1				
28	4 3/12	3 7/12						
30	3 9/12	2 5/12	....	....	2 5/12	....	1	
32	3 6/12	3 6/12	....	2 6/12	6/12	....	....	1
33	3 3/12	3 4/12	....	3 4/12				
40	2 5/12	1 5/12	....	....	1 5/12			
41	2 3/12	1 11/12	....	....	....	....	1	
42	2 2/12	1	....	1				
43	1 9/12	1 5/12	....	11/12	6/12			
44	1 9/12	1 7/12	....	1 3/12	4/12			
45	1 8/12	1 2/12	....	1 1/12	1/12			
47	1 5/12	1	6/12	6/12				
49	1	1	9/12	3/12				
Total	136 5/12	107 7/12	50 8/12	20 5/12	22 3/12	2 6/12	3	2[1]

It is not necessary for the surgeon to trace each case to the time of reporting his results. If he has lost track of his patient soon after operation this fact is clearly shown by his figures and the value of the data may be judged accordingly.

Formerly the most difficult of all cases to classify were the exophthalmic goitre cases. This was because almost no single case could be placed under a single heading. By the method here outlined even the exophthalmic goitre cases can be readily classified. The table shows 26 cases operated, a total of $136\frac{5}{12}$ years and traced $107\frac{8}{12}$ years. Of this time $50\frac{6}{12}$ years, or 47 per cent., of the total traced postoperative time the patients have been cured. An additional $20\frac{5}{12}$ years, or 9 per cent., of the time the patients have been satisfactorily improved, making 66 per cent. of truly satisfactory results. $22\frac{3}{12}$ years, or 21 per cent., credited in the improved column, represent improvement to such an extent that the patients feel well repaid for their operations. Only $2\frac{6}{12}$ years, or 2 per cent. of the postoperative time, has been passed as unimproved.

[1] The expected mortality for healthy individuals of the average age of these patients traced for an equal length of time would be 0.963, or approximately 1.

In my series there were 3 early postoperative and 2 late deaths. The expected mortality for normal risks of the average age of the patients in this series is 0.963, or not quite 1 normally expected death.

I believe that much of the time credited to the improved column in the table could properly be listed under the satisfactorily improved column. Thus Case II was practically cured of all symptoms of hyperthyroidism, but before and after operation she also suffered from true hysteria. In Case III the microscopic examination of the thyroid tissues removed was reported as probably malignant, being a solid, hugely cellular tumor. This patient was able to resume her normal occupations and continued in fair health for eight years, after which time she had a slow-growing malignant recurrence, from which she died nine years after the operation. I know of no other case on record of a patient living nine years after an operation for a malignant tumor of the thyroid. Case XXX reported as only improved, and yet he passed the physical examination for the Italian army and was killed in action on the Austro-Italian front in 1916.

It is worthy of note that 97 per cent. of the cured time is assigned to patients operated more than five years ago, while the more recent cases are found listed in the improved columns.

An analysis of the individual cases shows that in each patient a marked improvement followed almost immediately after the operation. In the majority of cases this improvement continued progressively, so that after from six months to two years the patient could be classed as cured. In every case the immediate improvement in the subjective symptoms was very marked. This was often out of proportion to the demonstrable improvement in the pulse, tremor and exophthalmos.

The improvement in the pulse rate and tremor was, however, always demonstrable at an early date. Most patients gained from 15 to 30 pounds in weight within a few months of the operation. As a rule, the exophthalmos disappears slowly, and for a long time following the operation the pulse rate is markedly increased by exertion or excitement.

Temporary acute recurrences of toxic symptoms are frequently met with during the first year or more following operation. These usually subside in a few weeks or they may be controlled by hot-water injections into the remaining gland tissue.

Conclusions. Removal of a portion of the thyroid gland of patients suffering from exophthalmic goitre produces a profound immediate effect noticeable within a few days of the operation and characterized chiefly by an improvement in the subjective symptoms of discomfort felt by the patient, but also accompanied by a marked fall in the pulse rate, a diminution of the tremor and an increase in weight.

This initial improvement, however, seldom amounts to a cure. The exophthalmos usually persists for months or years. The heart remains irritable, the pulse becoming rapid with exertion or excitement and at irregular periods we may expect acute exacerbations of toxic symptoms, which may alarm both the patient and the surgeon.

The general tendency is, however, toward improvement rather than recurrence, and after a variable length of time a few patients may have failed to improve or even have grown worse; but the great majority, I believe about 80 per cent., will have continued to improve, so that finally practically all traces of their former trouble disappears.

It is useless for the surgeon to claim that there is no medical side to the treatment of exophthalmic goitre. After five or six years there is probably little to choose from between the medical and surgical end-results as regards either the mortality or the condition of the surviving patients.

Patients surviving operation have been promptly relieved of the more distressing subjective symptoms, and the majority of them will have been able to return to their normal work in about half the time that it would have taken them to reach the same state of improvement under medical treatment. Against this is the primary mortality which must always accompany operations for exophthalmic goitre unless we are to deny the chance of operative relief to many cases most in need of the relief.

In the future the man best able to treat exophthalmic goitre will be the one who has developed the judgment necessary to enable him to select the treatment, medical or surgical, best adapted to the individual case. The decision will depend upon many factors, not the least of which will have to do with the social condition of the patient, and whether she or he can afford the time and expense necessary for the prolonged rest required to effect a medical cure.

THE CLINICAL DISPLAY OF SYPHILIS OF THE NERVOUS SYSTEM.[1]

By Joseph Collins, M.D.,

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There is no other way of convincing ourselves and our colleagues that syphilis attacks and disorders the nervous system early and often than to keep repeating it and furnishing new proof. Such repetition would seem trite and platitudinous did not our daily experience convince us that many patients with syphilitic disease

[1] Read before the American Neurological Association.

of the nervous system are neither correctly diagnosticated nor properly treated until the disease has existed so long that it is practically incurable. Until it is generally recognized (1) that syphilis is the most common cause of all organic nervous disease; (2) that the treponema invade the nervous system soon after the general infection; (3) that there are certain physical signs which are the hall-marks of syphilis of the nervous system; (4) that proper laboratory study of the serum and cerebrospinal fluid in conjunction with examination of the patient will make the diagnosis in every instance. I feel it my duty to continue to call attention to the frequency of syphilitic disease of the central nervous system and to the fact that it displays itself often as a clinical imposter.

Frequency of Syphilitic Disease of the Nervous System. During the past seven and half years there have been examined in the first division of the neurological institute, 12,468 patients. A considerable number of them, just how many I am not at this time prepared to say, suffered from metabolic disorders and from intoxications and infections other than syphilis. The diagnosis of syphilis of the nervous system was made or suspected 2036 times, *i. e.*, in about one-sixth of the cases. During the same period 3840 new patients were admitted to my service in the wards of the hospital, and of this number 922, practically 25 per cent. were found to be suffering from disease of the nervous system that had its origin in syphilis. Of these 922 patients I have taken the records of 830 which are sufficiently complete to satisfy the requirements of this inquiry and attempted to make a clinical diagnosis of each one of them. The result is set forth in the accompanying table:

Meningitis (basilar 19, cortical 13)	32
Meningo-encephalitis	5
Apoplexy	28
Progressive hemiplegia	7
Encephalitis (pseudoparesis)	6
Brain tumor	7
Epilepsy	8
General paresis	140
Imbecility (dementia)	4
Acute mania	5
Melancholia	7
Paranoid state	2
Korsakow's syndrome	1
Headache	16
Migraine	8
Insomnia	7
Neurasthenia	17
Thalamic syndrome	4
Weber syndrome	2
Pontobulbar	5
Bulbar apoplexy	3
Cerebellar syndrome	3
Ponto-medullo-cerebellar space	1
Dysarthria	1
Disseminated sclerosis	4

In this connection it may be said that I have for some time dispensed with making a clinical diagnosis of syphilis of the nervous system in all cases save tabes and general paresis. The etiological diagnosis, and usually the anatomical diagnosis, is made.

The most striking facts that these statistics set forth are: (1) syphilis of the nervous system constitutes about 25 per cent. of the neurologist's work; (2) tabes and general paresis constitute about one-half of syphilis of the nervous system; (3) when syphilis invades the nervous system the symptoms that result resemble so closely those of any disease of the nervous system that expert examination is necessary to detect it. The third of these statements requires some discussion, though it may be considered an elaboration of the obvious. In the table there are a certain number of cases of migraine, of trigeminal neuralgia, of poliomyelitis, of arthritis deformans, etc. I am not attempting to prove that there is such a disease as syphilitic migraine or syphilitic poliomyelitis. An individual who has had syphilis and upon whose soma it has written its signature may have attacks of migraine, of trigeminal neuralgia, of poliomyelitis or any other disease without such disease being of syphilitic nature. When the physician attempts the interpretation of such a case he must decide for himself whether or not the disease which the patient then has is of syphilitic origin. My criteria are if there is no other attributable cause, and if the disease yields to antispecific treatment, I am suspicious that the disease is of syphilitic origin. When I discover alteration in the cerebrospinal fluid, which is satisfactory evidence of an active syphilis in the central nervous system, my conjecture becomes a certainty. For instance, a patient who recovers from trifacial neuralgia under vigorous salvarsan and mercurial medication and whose serum and cerebrospinal fluid (Wassermann) becomes negative is considered by me to be a case of luetic tic douloureux.

Intracranial Syphilitic Diseases. There is nothing particularly noteworthy about the meningeal diseases due to syphilis in these statistics, save the fact that it did not seem justifiable to make the diagnosis of pachymeningitis, but in one instance, and that the basilar form of meningitis, was not, as it has usually been stated to be, so much more frequent than the cortical. The explanation of this is, I think, that the diagnosis of meningeal involvement was often made largely from a study of the cerebrospinal fluid in individuals who complained of headache, dizziness, malaise and prostration. Unless there was evidence of involvement of the cranial nerves the designation "basilar" was not added to the diagnosis "meningitis." That there is involvement of the meninges in many cases of cerebrospinal lues is beyond question, and when examples of such infection come to autopsy extensive characteristic lesions are found. Nevertheless, syphilitic disease of the coverings of the brain causing characteristic symptoms of meningitis is rather

unusual. The point that I desire to make is that syphilitic disease of the cerebral meninges often does not cause the ordinary clinical manifestations of meningitis.

The diagnosis of meningo-encephalitis was made when the individual had objective manifestations of syphilis plus symptoms of irritation of the meninges and of the cortex which has special functional allotment.

For instance an umbrella polisher complained for a week or so that the right hand and arm got tired easily. Then he developed headache which in a few days was followed by a right-sided facial paralysis. Examination four days later showed right seventh nerve paralysis of the peripheral type, right brachial monoplegia, partial astereognosis and lively tendon-jerks of the right upper and lower extremities, serum Wassermann plus, cerebrospinal fluid (Wassermann) plus, globulin plus, Fehling's plus and cells 85. Within a week he had a typical Babinski big toe phenomenon of the right side, but no indication of hemiplegia. He recovered and the serology became negative.

The most likely diagnosis in such a case would seem to be meningo-encephalitis of the lower left Rolandic cortex. The laboratory reports conclusively exclude a vascular lesion, and a peripheral lesion would not be adequate to explain all of the manifestations.

The relationship of disease of the cerebral bloodvessels to syphilis is a definite one, and the facts of it are firmly established clinically and anatomically.

There is nothing particularly new brought out by study of our cases of cerebral apoplexy, save the fact that in some of them were it not for the existence of a positive serum reaction the arterial disease would not be attributed to syphilis. For instance, a brewery worker, aged forty-nine years, who denied having had syphilis, awakened at 3 A.M. with cramp in the left leg. On attempting to move the leg with the left hand he found he could not. The left hand felt as if it were asleep. He walked about for an hour or so then the symptoms disappeared. At 9 A.M. the left side became paralyzed. The leg recovered in two days, but the upper extremity was quite paralytic when he was examined five days later. In addition there was partial left lower facial palsy, the tendon jerks of the lower extremity were exaggerated and the Babinski big toe phenomenon was elicitable. Superficial and deep sensibility were normal and the pupils were circular and responded to light. The serum Wassermann was plus, cerebrospinal fluid negative throughout, systolic blood-pressure 180. Without the laboratory findings the case would have been considered an arteriosclerotic cerebral thrombosis, but with them we must assume it to be one of luetic arteritis. No one would think of denying that a patient with symptoms of aortitis whose blood serum showed a positive Wassermann was suffering from vascular syphilis.

The cases of progressive hemiplegia in our series, 7 in number, were of a fairly constant clinical type which bespoke their dependency upon luetic endarteritis.

Syphilis of the brain displays itself occasionally in such a way as to suggest a diagnosis of brain tumor. But these statistics do not seem to show that gumma of the brain is often diagnosticated as brain tumor. Often the symptoms yield with astonishing readiness to appropriate treatment. A married Italian, aged thirty-seven years, who became infected with syphilis when he was thirty-three, complained in August that his right side felt queer, especially the arm. About six weeks later, while cutting a piece of ice, the right hand began to jerk and the right side of the face screwed up. This disappeared in a short time. He did not lose consciousness and he did not become paralyzed. Later he complained of severe headache. Three months later he had another attack, in which he became partially hemiplegic and unable to talk, and with this there developed left strabismus. On March 1, 1917, his complaint was of severe headache, dizziness, vertigo, diplopia, inability to talk understandingly, poor memory and right-sided hemiplegia.

Examination showed evidence of slight right-sided hemiplegia, left external rectus palsy and 3 diopters of papilledema.

Laboratory examination: serum Wassermann plus, cerebrospinal fluid (Wassermann) plus, cells 22, globulin plus, Fehling's plus.

May 1, 1917, all subjective and objective symptoms, save occasional vertigo, had disappeared.

Epilepsy occurring in an individual who has had syphilis is presumed to be luetic. It need scarcely be said that an individual with idiopathic epilepsy may contract syphilis which shall have no relationship to his nervous disease. Syphilitic epilepsy is the expression, as a rule, of a focal encephalitis or meningo-encephalitis, chiefly vascular or of a gumma which does not produce characteristic manifestations of increased intracranial pressure.

Epilepsy as the result of luetic infection may be expected to give one or more of the reactions found with a positive serology. Of this the commonest is a positive serum Wassermann and the rarest a general paresis colloidal gold curve. The latter, however, will occur in a paretic with epileptiform manifestations. There are many disorders or diseases classified under the name epilepsy that give a positive Wassermann reaction, the result of a luetic focus outside of the nervous system; but there are cases of epilepsy that give a positive Wassermann reaction in a peculiar fashion not the result of syphilis. At present it must be interpreted as an idiosyncrasy of the particular patient. These reactions are characterized by a negative Wassermann reaction in the serum when cholesterinized antigen is used and a strongly positive reaction when the non-reinforced extract is used. This paradoxical behavior which has yet to be explained is found only in some patients, about 30 per cent. of our own cases.

WHAT IS PSEUDO GENERAL PARESIS? If there is such a disease as pseudoparesis it is a disease founded on disseminated encephalitis.

Pseudoparesis is a very indefinite designation. What most writers mean to convey by it is that the individual who has the disease resembles a paretic, but that some of the cardinal features are lacking. The course of the disease does not conform to that of general paresis and sometimes it terminates in recovery. I have had the experience which I have no doubt many others have had, to be obliged to transfer cases labelled pseudoparesis into the category of true paresis after an interval of several years. On the other hand, I have had the experience to do the reverse. I am suspicious of the correctness of my diagnosis of pseudoparesis until after a number of years has elapsed. There is no doubt that syphilis of the brain causes occasionally mental and emotional disorder suggesting general paresis, but some one of the essential features of the disease is lacking. It is particularly in these cases that the laboratory is of signal aid in making a diagnosis.

The paretic curve of the colloidal gold reaction has been demonstrated to be a most trustworthy diagnostic criterion. Many cases which are not typical of general paresis may unhesitatingly be diagnosticated when this test is positive.

For instance, take the case of a barber, aged twenty-eight years, who maintained that he was well until February 28, 1914, when he slipped on the icy sidewalk, and in attempting to save himself from falling wrenched his body. The next morning he was unable to walk properly because of numbness of the right side, which increased for forty-eight hours and practically incapacitated him. It then gradually grew less, but the right side of the body always remained weak, and it was for that weakness that he sought relief. Physical examination showed arterial hypertonous, systolic blood-pressure of 250; weakness of the right extremities as compared with the left, with livelier tendon-jerks, Babinski and ankle-clonus on the right side, and Argyll-Robertson pupils. Mental examination showed impaired memory, poor attention, fair insight and slight depression. There were no delusions and nothing suggestive of seriously impaired judgment. He made some mistakes in writing and in computation, and when they were pointed out to him he contended that he was no scholar. Laboratory examination: serum Wassermann plus, cerebrospinal fluid (Wassermann) plus, globulin plus, cells 190, Fehling's plus, colloidal gold, typical paretic curve. This patient died in a State hospital two years after the beginning of the disease and the diagnosis was general paresis.

In contrast with this case was one in which suspicions of general paresis had been entertained. A railway engineer, aged sixty-three years, was seen October 26, 1910. Three months before that date he began to experience a sensation of dizziness, especially when he stooped or made the least effort. Soon after this he got

generally weak, so that at times he was unable to reverse the lever of the locomotive, and often had to ask his fireman to do it. He then developed within a few weeks headache, especially in the left temple, drowsiness, crying spells without cause, inability to speak clearly—that is, to say what he wanted to say—disturbance of articulation, forgetfulness, disordered vision and loss of weight. Physical examination showed a blood-pressure of 140, and a sphygmographic tracing revealed a moderate degree of peripheral obstruction; tremor of the outstretched fingers and of the lips and indistinct articulation. Mental examination revealed depression, impaired memory, defective attention, loss of insight and poor judgment. Emotionally he was very unstable. Laboratory examination: serum Wassermann plus, cerebrospinal fluid (Wassermann) plus, globulin negative, cells 11, Fehling's plus. He received two treatments of salvarsan and protracted mercurial treatment. A letter from him seven years later, recently received, states that he is perfectly well and that he has been steadily at work as a locomotive engineer since six months after his stay in the hospital.

As a matter of fact neither of these cases is an example of pseudoparesis in the sense that I use it. The term "pseudoparesis" I apply to a form of cerebrospinal syphilis which is anatomically found chiefly in endarteritis, the lesions being very diffuse and not chiefly of the cortex, but of the basilar ganglia, the latter being responsible for the bilateral physical symptoms which they almost always display. One of the best examples of that disease is a young man, now in the Manhattan State Hospital, who came under my observation two and a half years ago. He was then thirty years old. He became infected with syphilis when twenty-four and had been under treatment off and on since that time; mercury internally and by inunctions and three intravenous injections of salvarsan. Early in January, 1915, he began to complain of headache, loss of memory, frequent dizziness, drowsiness and disinclination to work. It was noticed by his family that his speech had become slow and laborious, that he was slow of comprehension, that his handwriting was unsteady, while his employer had noticed that he made mistakes in his clerical work. Within a fortnight his condition became very much worse. On January 14 it was noted that there was a slight left-sided paralysis, though he could walk without evidence of hemiplegia, and he could also use his left hand. The next day he was mildly delusional, thought his dead father was living and believed his brother who had married and moved to his own house was still at home. He thought people had been to see him who had not been. His memory for past events was excellent but poor for current events. His discourses were intelligent, and he recognized people, pictures and objects and was able to read correctly a few newspaper headings, but could not read the paper. He was exceedingly drowsy and tended constantly to fall asleep, complained of headache, backache, pain in the left shoulder and felt very stupid.

He was admitted to the hospital on January 18, 1915. Physical examination revealed fine tremor of the lips, tongue and hands, overactive tendon-jerks, Argyll-Robertson pupils. Serological examination: serum Wassermann plus, cerebrospinal fluid plus, globulin plus cells 30, Fehling's solution plus. The colloidal gold test did not show the characteristic paretic curve of general paresis. Mentally he was well oriented, recalled when he had come to the out-patient department, gave a description of the physician who had examined him, but he was somewhat confused about dates, the month and day, and tended to fabricate mildly. He told of having written certain letters, having gone out to mail them, stopped at certain places, during which time he was in the hospital. He was not euphoric, he had insight as to his condition and he was solicitous about his welfare and recovery. On the evening of the next day the patient suddenly went into a state of collapse; breathing rapid and stertorous; body covered with cold sweat; pulse, 76; blood-pressure, 135. This was soon followed by complete right-sided hemiplegia and total aphasia. The following morning the hemiplegia was only partial and the patient coöperated well during the examination, apparently comprehending everything that was said to him and occasionally making spontaneous utterances, such as "it hurts." All the tendon-jerks were exaggerated, those of the left side livelier than the right, the left ankle displaying a typical (the right an incomplete) clonus, and the Babinski phenomenon was elicited in both feet. Ten days later the evidences of hemiplegia had practically disappeared, his physical condition remained otherwise about the same. Mentally his condition did not differ materially from that of the time of his entrance. He became very easily fatigued, and when fatigued was confused and his answers were not always responsive or intelligible. On February 6 he had another collapse attack, even more profound than the previous one. Pulse, 120; respiration, Cheyne-Stokes type; cold extremities; on this occasion there was no paralysis. A week later it was noted that the patient was again fabricating and was slightly confused. He answered questions promptly, most of them correctly, but displayed very little interest in things going on in the world or immediately about him. There was now very little trace of the right-sided hemiplegia in his gait or use of the upper extremity. His condition gradually improved, and on February 19, his serology being then negative and he having had five intravenous injections of salvarsan, he was allowed to go home. He received another salvarsan treatment in March and another on April 2. It was then noted that there was no gross disturbance of memory either for past or recent events. His behavior was orderly and he was well oriented for time and space. There were no indications of delusions or hallucinations. His answers were terse and to the point. He had good insight into his condition; regarding himself,

he was much improved, but not profoundly well. He thought, however, that he was well enough to be allowed more independence than he had, such as to go to the barber alone, etc. The pupils were irregular, and of the Argyll-Robertson type; slight right facial weakness; no tremor of the lips; the tendon jerks were all exaggerated and the ankle and Babinski phenomenon remained as before. The laboratory reports at this time were all negative, save that the cerebrospinal fluid showed an excess of globulin.

May 10 the serology was again negative. Nevertheless he was given an intravenous injection of salvarsan. His memory was good for past events and better than for recent. It was difficult for him to give details of anything. He recalled persons that he met, but was unable to recall the conversation he had with them. He had no delusions and no grandiose ideas. The grasp of a subject was poor and he admitted that he did not quite understand everything that he read or what was read to him. He knew, however, that he had a paralytic stroke; understood the nature of his disease; realized that his mind was unbalanced and he was ashamed of sexual excitement which he had had and which he recalled.

May 25 he became violently excited, profane, obscene and indulged in the most abandoned sexual conduct. A physician was called who gave him an injection of morphin. The next morning he refused to come to the hospital but was persuaded to do so, and when he arrived there he maintained that he had come to his senses. His physical and mental condition did not seem materially different from that when he was last examined. Two years after that date Dr. Hoch writes his physical condition showed bilateral increase of knee-jerks, right more than the left, bilateral Babinski, slightly slurred speech, tendency to convulsive laughter, pupils that respond sluggishly to right and negative laboratory report, save a slight increase of globulin. On the mental side it was difficult to establish a definite intellectual defect, but he seemed to be somewhat shaved off. somewhat childish and possibly did not fully appreciate his situation. He had had several intraspinous salvarsan treatments without discernible affect.

It is very interesting to contrast this case with another that we have had under observation for upward of seven years. The patient was a young man of education and social distinction, aged thirty-two years, who contracted syphilis when eighteen. It is probable that he had little or no treatment. When he was thirty-one years, he began to complain of insomnia and nervousness and felt "run down." He took a protracted holiday and then returned to his journalistic work. On or about this time he consulted Dr. James J. Putnam, complaining of pains in the lower part of the back and buttocks, constipation, stiffness of the knees and ankles, with occasional sharp pains, numbness in the feet, sensation of being unsteady while walking in the park, slow micturition, impaired

sexual potency and constipation. The pupils were normal, speech was distinct, intelligence unimpaired and tendon-jerks normal. The only objective signs were disorder of deep sensibility in the toes and feet and well-marked Romberg. The diagnosis of tabes was made. A few months later he became unconscious suddenly and remained so twenty minutes, then he went into a profound sleep and on awakening he vomited. The next day, however, he went to the office and kept at work for four months—namely, until February 9, 1909—when he became garrulous, expansive, hilarious and hallucinatory. In this hallucinatory state he had to be carefully guarded.

April 26, 1909, he had a generalized convulsion and was unconscious half an hour. A month later he had another convulsion, and after this attack it was noted that his memory was impaired. During the remainder of 1909 he had eight convulsions accompanied by loss of consciousness and followed in several instances by inability to speak for a time, varying from a minute to three days.

October 24, 1910, he had five convulsions in succession, lasting altogether about three hours, and following this status epilepticus he was unable to speak for three days. After this he displayed increased mental enfeeblement. In the latter part of December, 1910, the attacks assumed the petit mal type, and from March 20 to March 25, 1910, he had a series of these petit mal attacks, constituting a milder form of status epilepticus than in the previous October. These attacks lasted for from two to three minutes and began with manifestations of increased restlessness and excitement. He usually began yelling "Oh! oh!" and then became slightly rigid, the face suffused, the eyes twitched and he appeared to lose consciousness for a few moments. After the attack was over he was quiet, subdued and listless for a variable time. It was related when he was brought to the hospital March 29, 1910, that he had not spoken since the series of attacks four days before. Examination showed a powerfully built, well-nourished young man who displayed the following physical signs: irregular Argyll-Robertson pupils, slight ataxia of station and gait, absent knee- and ankle-jerks. He did not answer questions, though apparently able to hear. He spoke rarely if he desired something, fed himself, was interested in his appearance and clothes and in general comported himself like a rational person. He read the papers, but often gazed for a long time at one article; he played solitaire and smoked and was fairly amenable to hospital routine.

Laboratory examination: serum Wassermann plus, globulin plus, Fehling's plus, cerebrospinal fluid (Wassermann) plus, cells 13. He was put on active mercury treatment and not seen again until June 27, 1910. It was then noted that he talked if he wished something, but would not respond to questions. He would not go out with his nurse but would go out with his sister. He seemed to have

forgotten his friends when they came into the room where he was. He would stare at them but would not speak. He slept fairly well but arose early, dressed himself and was busy doing trifling things—playing with a picture puzzle, twisting a string, going through his pockets, etc. He rarely spoke when he wanted anything, but he would draw a picture of it and then take it to his sister and hold it before her gaze. He insisted upon having his own way and became excited and angry if he was resisted. In July it was noted that one night after a short nap he began to talk. He said that he had no recollection of leaving Boston or of the circumstances attending it; that he did not know how long he had been in New York and inquired what had happened. He said his head felt queer, then he got a dictionary and looked up the word "insane." He then went to his sister and patted his chest and said he was insane. He then went back to bed and the next morning when he awakened he was in his customary state of silence and purposeless activity. He had no grand mal attacks after this time but he had frequent petit mal attacks. From this time onward his voluntary speech grew gradually less, until about in a year he ceased to speak at all. Many attempts were made to test his sense of hearing, but without result. There was gradual impairment of physical and mental vitality. He had to be constantly cared for like a young obstreperous child. He was not violent unless he was crossed, and when handled the right way, particularly by his sister, he was fairly tractable. His only mental activities seemed to be in doing simple picture puzzles; his sole diversion was in smoking and aimless arranging and rearranging his things, dressing and undressing. He received much antisyphilitic treatment, salvarsan and mercury, and the serological reactions all became negative. Sometimes it appeared that he was more intelligent, more tractable, more capable of looking out for himself, but each succeeding year he was more demented and more infirm physically. The early winter of 1917 a more decided change came about in him. He began to have attacks in which he would laugh, shout, *halloo* and yell at the top of his voice. These seemed to have replaced the petit mal attacks which had been so frequent in the previous year. They came in spells and lasted for a few minutes to two or three hours, and while seized with them he was very boisterous and difficult to control. It was also noted that he was not conducting himself as well as usual. When walking on the street with his sister he would attempt to stop women and shake hands with them. In eating he would stuff his mouth full of food and then attempt to take some liquid; it would run out over his clothing and the table. He lost all sense of modesty. The most striking feature of his conduct, however, was his motor restlessness. He would scarcely remain quiet for a minute unless occasionally when he was engaged in making simple picture puzzles. He would dress and undress many times a day. No sooner had he finished

dressing than he would start undressing, and *vice versa*. He would put something out of his hand like a nail file or watch and then search for it here, there and everywhere. If he did not find it he would go to his sister and by gestures and yelling make a disturbance until it was given to him. Then in a minute he would mislay it again and the search would begin all over. In the meanwhile he had become much more unsteady on his feet and his hands displayed great loss of dexterity. His general make-up was that of a very weak-minded and undisciplined child. The remarkable feature of it is that he had never become violent to such a degree that his sister could not readily soothe him. The only distinct recollections that he seemed to have were of habits, such as smoking; when a strange man came in the room the patient would point to his pocket and make gestures of smoking: a request for a cigarette. When walking in the street he would endeavor to drag his sister into a cigar store. He recognized a picture of his mother who had died during his illness and he often led his sister to it. Restlessness, sleeplessness, dementia and attacks of yelling, screaming and laughing, which seemed to have replaced the petit mal attacks, were the distinguishing features of his condition. From 1911 to 1916 his Wassermann reactions were practically negative. Laboratory report on May 1, 1917: serum Wassermann weakly plus, cerebrospinal fluid (Wassermann) plus, globulin plus, cells 12, Fehling's plus, colloidal gold, typical paretic curve.

In other words, nine years after the onset of the disease that had been considered typical parenchymatous cerebrospinal syphilis he presents the laboratory features of a general paretic and the clinical features of a terminal dement.

The larger my experience the more convinced I become that pseudo-general paresis nearly always eventuates in general paresis. The modern treatment of syphilis of the brain displaying itself in the guise of paresis delays the progress of the disease, increases the intervallary periods, during which the disease seems to be in abeyance and the patient able to resume the ordinary duties of life, shapes in an obstruction measure in many instances the course of the disease, but despite this the outcome finally is general paresis and dissolution.

Syphilis and Mental Disorder. The relation of syphilis to mental disorder aside from general paresis is strangely negative save for a form of subacute dementia, subsequent to and associated with a semidelirious state which terminates in more or less complete recovery.[2] It has small relationship to the causation of mental disorders that lead to insanity. In a few instances syphilis of the brain displays itself by symptoms which in their ensemble constitute mania, melancholia and involutional states, but here again it

[2] For detailed examples see the writer's Neurological Clinic. Paul Hoeber, New York, 1918.

is difficult to decide whether or not their occurrence in syphilis is not a coincidence. Syphilis has a definite relation to mental and emotional disorder and disequanimity which does not lead to insanity. It may have a relationship to disorderly conduct and unlaudable behavior from which disease of the nervous system indirectly flows, such as the use and abuse of alcohol, intemperateness in other directions, and thus be a contributory cause of mental disease, of its rebelliousness to treatment. The possibilities of its entailments often cause depression, anxiety, agitation and sometimes obsessive states, and it may well cause that instability of the mind and emotions in the descendants, which we speak of as the psychopathic constitution. Granted all this, syphilis has a strange aloofness from all mental disorder save general paresis, considering the readiness with which it invades and conquers the central nervous system

Syphilitic Disease of the Midbrain and Pons-oblongata. The midbrain and pons-oblongata is a favorite location for syphilitic vascular and meningovascular disease. In 23 instances of this series the chief location of the disease was there. There is nothing particularly noteworthy about any of these cases save the typicalness of the clinical pictures and the fact that some of them had existed for a long time. The series includes one case of pontobulbar luetic disease which I published twenty years ago.[3]

The Luetic Spinal Cord Diseases. It seems quite incredible that a few years ago it was widely held that tabes was not a syphilitic disease, so universal is its acceptance now. The fact that it is diagnosed earlier and from fewer data than it was formerly accounts for what seems to be its greater prevalency. It constitutes about one-seventh of all nerve syphilis.

Some of the cases that I have included under the caption of myelitis others might have been placed under the heading of early tabes, but in reality there is no clinical diagnosis that can be made satisfactorily. For instance a pressman, aged thirty-nine years, who became infected with syphilis when he was twenty-eight, complained that he had difficulty in holding the urine of six months' duration and of partial impotency. On inquiry he admitted that for several years he had seen double once in a while, and at times the legs felt very heavy and tired easily. He also admitted that recently he had a sensation of numbness in the heels. Physical examination was quite negative, save that the pupils had lost their contour and that the light reaction was sluggish. His laboratory report was: serum Wassermann negative, cerebrospinal fluid posipositive, globulin positive, cells 61, Fehling's positive, colloidal gold, non-paretic curve. In reality the only suitable diagnosis to make in such a case is cerebrospinal syphilis.

[3] Medical Record.

There are very few clinical problems that are more difficult to solve than the distinction between disseminated sclerosis and disseminated cerebrospinal lesions of syphilitic origin. As a matter of fact it has been my experience that at times the diagnosis cannot be satisfactorily made. I have in mind a patient who has been under observation for the past five years, a young man now thirty years old, and who had never had syphilis. He complained in his twenty-fourth year of difficulty in starting the urinary stream; a year later he noted that his eyesight was failing. Within a month walking became difficult, he wavered from side to side, his heels would come down first and he would have difficulty in maintaining his balance. A month later he complained of numbness and tingling in the right hand and loss of skill in using it. Six months later he complained of numbness and tingling in the feet and legs extending up to the knees and a sensation in the feet as though they were wrapped in cotton. He grew steadily worse, all save the vision, which seemed to remain stationary. Physical examination showed difficulty in standing and walking; gait spastic ataxic; no tremor; tendon-jerks exaggerated; double Babinski; abdominal and epigastric reflexes absent. Ocular examination: pupils slightly irregular in shape and size; light and convergence reaction good; no diplopia; no nystagmus; vision: right 6/200, left 5/200; for 2 mm. test object large central scotoma in each eye; peripheral field normal; fundi, slight; diffuse pallor, more marked in the temporal half of each optic nerve; arteries rather small, not sclerotic. General interpretation of ocular condition: retrobulbar neuritis with central scotoma in each eye. No marked emotional instability; no speech defect; memory good; attention excellent.

Laboratory report: serum Wassermann plus, cerebrospinal fluid negative. He received five doses of salvarsan and was not seen again for three years. Meanwhile he had been to Germany; received further salvarsan medication there and mercury treatment at one of the spas. His infirmity had progressed in every feature. He now recalled that when he was about twenty years of age he had a small preputial ulceration to which he gave no attention. His serological examination now was entirely negative, save that the cerebrospinal fluid contained 17 cells to the cubic millimeter. In such a case it is practically impossible to make the differential diagnosis. He does not conform to the classical disseminated sclerosis, nor, on the other hand, is there anything typical of cerebrospinal syphilis about his clinical picture, and were it not for the positive Wassermann reaction in the serum found repeatedly at different laboratories could that diagnosis be maintained.

The Brown-Séquard syndrome is not so rare a manifestation of spinal syphilis to make it of interest to report such condition. In one of the cases in this series it was rather unusual. A mechanic, aged thirty-four years, who had had a chancre when he was twenty,

had been complaining of upward of a year of a numb, heavy sensation in the right leg and a sensation as if something were running through it. He had noted latterly that he could not distinguish between hot and cold in this leg. He complained also of a jumping restless sensation in both lower extremities and of weakness of the left lower extremity. On inquiry it was found that in reality he had become paraplegic about two and a half years before and the condition for which he sought relief was in reality the sequelæ of it. The objective examination revealed anesthesia and analgesia from the fifth dorsal segment downward on the right side and of weakness of the left lower extremity accompanied by increase of the tendon-jerks on that side. His serum Wassermann was positive and the cerebrospinal fluid negative throughout. In this case the Brown-Séquard paralysis was merely a sequelæ of a meningomyelitis displaying itself in transverse lesion.

There are two cases of poliomyelitis, both adults, in our statistics. Whether these are cases of syphilitic poliomyelitis or of epidemic poliomyelitis occurring in a syphilitic individual seems to me impossible to say, but my conjecture would favor the latter view. For instance, an Italian laborer, aged thirty years, was taken ill suddenly and soon had a high fever; at the end of two days the fever was less intense and the left lower extremity was completely paralyzed. Six days later the right shoulder began to be painful and shortly afterward this extremity became paralyzed. He regained the use of the upper extremity and on examination showed comparatively slight atrophy. The lower extremity, however, showed the typical appearance of former poliomyelitis: dangle knee and ankle-joints. The tendon-jerks in this extremity naturally were not elicitable, but they also were not elicitable in the right lower extremity, which had never been affected. The pupils were irregular in contour, uneven and displayed the Argyll-Robertson phenomenon. The serum Wassermann was plus and the cerebrospinal fluid negative throughout. In the absence of a history of syphilitic infection, were it not for the positive Wassermann of the serum and the Argyll-Robertson pupils there would be no suspicion aroused that the disease was other than an example of ordinary poliomyelitis.

It is even more difficult to decide a case such as the following:

A school girl, aged thirteen and a half years, complained of headache and pain in her chest and in the back; this lasted two or three days and she returned to school. Two weeks later she complained of pain and drawing in her feet, and before the end of the day she had to be helped home from school. The next two days she lay around the house and then went to bed because she was unable to get about without help. Examination four days later revealed that she was unable to stand securely without assistance. There was generalized weakness of the legs and arms, no distinct

atrophy; the tendon-jerks were all absent; there was no tenderness of the muscles or nerves; there was no Kernig's sign and no sensory disturbance. Pupils were normal; no reaction of degeneration but distinct hypo-excitability to both currents.

Laboratory report: serum Wassermann plus, cerebrospinal fluid (Wassermann) plus, globulin plus, cells 4, Fehling's plus.

She recovered under salvarsan and mercury medication. The tendon-jerks of the lower extremities never became elicitable. The subject of progressive muscular atrophies dependent upon syphilitic lesion has already been presented by me before this Association, so I shall make no further reference to it.

In our series of cases there were a number of instances of facial paralysis and trigeminal neuralgia in which the blood gave a positive Wassermann reaction and the patients recovered under antisyphilitic treatment. As has been said in another connection, it need not necessarily be that these are examples of syphilitic disease.

In many of these cases of neuralgia it was obvious from consideration of the symptoms and their response to treatment that other factors than syphilis may have had causative relationship, and particularly dental infections.

A travelling salesman, aged fifty-two years, who got infected with syphilis when nineteen and who received prolonged mercury and iodin treatment, had complained for nine months of severe pain in the left shoulder, continuous but subject to intense exacerbation when the pain radiated down the arm and up the neck. Besides he complained of numbness in the left ulnar distribution. Examination showed in addition to tenderness over the brachial plexus Argyll-Robertson pupils; roentgen-ray examination of the teeth showed three large abscesses and one extensive pus cavity in the root of a tooth that was supposed to have been extracted. The laboratory examination: serum Wassermann plus, cerebrospinal fluid (Wassermann) plus, globulin plus, cells plus, Fehling's plus.

Within a week after the teeth containing the abscesses were removed, and the pyorrhea overcome, the pain disappeared, though he had received but one intravenous injection of salvarsan.

In view of our ignorance of the pathogenic properties of Spirocheta buccalis, Treponema macrodentium and Treponema microdentium mucosum, we can only conjecture what part they played, if any, in causing these symptoms. The patient, however, completely recovered under salvarsan medication.

For a long time it was a matter of contention whether or not syphilis produced multiple neuritis. It seems to have been definitely established that it can, but that such cases are extremely uncommon is shown by these statistics. However, now and then we encounter a fairly classical example. An Italian laborer, aged forty-two years, who used alcohol very moderately, became ill a month before he came to the hospital, with vomiting, which lasted about

four days. When the vomiting ceased he began to have pains in the soles of the feet, pins-and-needles sensation in the knees, weakness of the lower extremities, giving way of the knees, and soon after of pins-and-needles sensation in the finger-tips, associated with a sensation of numbness. He soon began to find difficulty in buttoning his clothes and using a knife and fork dexterously. The affection of the lower extremities increased so that he had much difficulty in walking. Examination showed feeble gait, uncertain station, tremor of the outstretched fingers, absent knee- and ankle-jerks, atrophy of the lower extremities, more marked in the anterior tibial group of muscles, tenderness on pressure over the nerve trunks, of the extremities and symmetrical hypesthesia. The pupils were normal. Blood serum Wassermann positive, cerebrospinal fluid negative.

Again, it must be admitted that this is a case of multiple neuritis occurring in a syphilitic individual, whether or not we are justified in calling it syphilitic multiple neuritis cannot be said. In the absence of the ordinary causes of neuritis, such as alcohol and infection, it can be surmised only.

I quote an example of a case in which the diagnosis of rheumatism is made. A married man, aged thirty-four years, occupied as a packer, complained that eight weeks before he came to me he was suddenly taken with pain and swelling in the right ankle. In about two days the left shoulder and then the right wrist became involved, and a few days later the right shoulder and finally the left wrist became affected. Aside from that he had no other complaint. He denied syphilis but admitted gonorrhea a year previously. There was no evidence of syphilitic disease, save sluggishness of the pupils to light. Laboratory examination: serum Wassermann plus, cerebrospinal fluid plus, globulin weakly plus, cells 253, Fehling's plus.

Whether this is a case of rheumatism occurring in a syphilitic individual or whether it is a syphilitic rheumatism every physician will have to decide for himself. It might meanwhile be said that the patient made rapid recovery under the administration of salvarsan and baking to the joints and appropriate diet.

Perhaps there is nothing more astonishing than to find on examination of the cerebrospinal fluid evidences of intense infection in an individual who has practically no symptoms. I saw in January, 1916, a mechanic, aged thirty-five years, who maintained that he was not ill. He had had a chancre when he was twenty years old and he wanted to be assured that he was in good condition. On direct questioning he admitted that he had at times indefinite queer sensations in the head as if he were going to have headache, and that occasionally he felt "slightly faint." The only objective sign was the Argyll-Robertson pupil. Serological examination:

serum Wassermann plus, cerebrospinal fluid (Wassermann) plus, globulin plus, cells 56, Fehling's plus.

His laboratory reports became negative under intensive treatment, but a year after the cessation of such treatment they were positive again.

The diagnosis of syphilis of the central nervous system is not such a cut-and-dried mechanical matter as one might infer from reading accounts of cases that have offered difficulties of interpretation. We encounter not a few cases in which, despite the most searching and repeated examination, it is impossible to say satisfactorily what the disorder really is. I have in mind particularly the case of a negress, aged thirty-eight years, who entered the hospital complaining of pain and numbness in the right upper extremity extending from the hand to the shoulder and radiating around the back and chest. This pain, which was continuous but subject to exacerbation, she had had about four months. Aside from impaired strength in the right hand there was no other complaint. Physical examination revealed pain on pressure over the right brachial plexus and hyperesthesia in the domain of the radial nerve. The serum Wassermann was negative on the first examination, but on three successive examinations and in two different laboratories it was positive. The cerebrospinal fluid showed no abnormalities save an excess of globulin. The blood showed nothing abnormal save a low hemoglobin index and the stomach contents were normal save for mild subacidity. She was put on general tonic treatment, including glandular extracts, and for a while she felt better, but two months later she was complaining of paresthesia and numbness of the feet. These symptoms increased in severity until they overshadowed the pain and paresthesia in the right upper extremity. After a few weeks' stay in the hospital she felt better, but after two months she was back again complaining of the same symptoms, and in addition a sense of constriction around the waist, of heaviness in the legs as though they were paralyzed, of distress in the rectum and of general malaise. Again her serum Wassermann was found positive. There was no objective evidence of disease. She received several doses of salvarsan and much mercurial treatment. The serum Wassermann became negative, but she admitted very little improvement. In the discharge note of September 13, 1915, it is noted that she still complained of a band-like sensation of numbness and tingling in her lower extremities and of a sensation as if she were walking on something soft, of pain in her shoulder and of general weakness. In March she was in the hospital again, complaining of severe pain in both arms, associated with a drawing, pulling sensation; of an aggravating, exhausting pain in the thighs; the legs felt like lead; station and gait were feeble and she had difficulty in climbing stairs. Examination showed uncertain station, moderately ataxic gait, defi-

nite loss of postural sense in the lower extremities, but no disturbance of superficial sensibility. The tendon-jerks and superficial reflexes were quite normal.

Examination of the blood showed no morphological alterations.

A roentgen-ray of the teeth failed to reveal abscess cavities. The urine showed nothing abnormal.

Six months later she was admitted again with the same complaint. She had now become thoroughly demoralized and her conduct was what is commonly called hysterical. The results of physical examination were now somewhat different from previous ones. There was distinct ataxia of the lower extremities, the tendon-jerks were exaggerated and an exhaustible clonus was elicitable. The Babinski phenomenon existed in the right foot, and neither the abdominal nor epigastric reflexes could be elicited. There was distinct disturbance of postural sensibility in the lower extremities and slight general tenderness of the lower extremities in both nerves and muscles. There was no disturbance of cutaneous sensibility. She cried and moaned, insisting she was suffering terribly and that nothing gave her any relief. The physician who took care of her after she left the hospital informed me that she grew rapidly worse and died suddenly two months later. She continued to have pain in both legs and lower abdomen without loss of reflexes and without apparent paralysis. Her emaciation and weakness was progressive, and she finally lost control of both rectum and bladder. She died suddenly about eighteen months after the beginning of her symptoms. Were it not for the positive Wassermann there was nothing in this case particularly to suggest syphilis of the nervous system, save that one husband had had syphilis, that she had had one miscarriage and that she was a negress. The course of the disease and its termination in sudden death suggests syphilis, but it is very difficult to conjecture what the pathological process was. Had we not been in possession of the information given by repeated examination of the blood we might be inclined to look upon the disease as a combined sclerosis of hemic origin.

The gist of this presentation is that syphilis of the nervous system may and often does cause the symptoms of practically every disease of the nervous system. The practical application of the conclusion is that no one can be sure that syphilis may not be an etiological factor until after laboratory investigation has been done. Syphilis invades the nervous system and often disorders it without producing the most constant pathognomonic sign, namely, loss of circularity of the pupils and impaired response to light and shadow. The sure way of curing syphilis of the nervous system is to prevent it.

"PUDENDAL HERNIA."

By Alexis V. Moschcowitz, M.D.,

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Early in the nineteenth century Sir Astley Cooper described for the first time a hernia to which he gave the name of "pudendal hernia." As the name implies, this hernia is located in the region of the pudendum. This name is, however, incorrect for the following reasons: (1) because the name does not sufficiently differentiate a pudendal hernia from the very common oblique inguinal herniæ of large dimensions, which also occupy the pudendum, and (2) because, contrary to our usual custom, the name is derived from the ultimate resting place of hernia and not from the point of its escape out of the abdomen. A much more preferable name would be "subpubic hernia," a name first proposed by von Winckel and one which describes the salient point of the hernia, namely, that it escapes behind or underneath the pubic bone even in the absence of any other descriptive qualifications. In spite of the great rarity of this hernia the name appears to be universally adopted, and it is hardly worth while to make very strenuous efforts to change it.

A number of years ago there was referred to me a patient with a pudendal hernia who had undergone the usual vicissitudes attending the treatment of such herniæ. I have refrained from publishing the case before because I wished to report in addition to the hernia also the late result of an operation of a somewhat novel nature:

Mrs. E. L., aged forty-one years, was referred to me by Dr. S. Steiner, May 15, 1913. The history prior to 1895 is irrelevant. The patient was delivered by forceps November 18, 1895, at the termination of the first pregnancy. The indication for the use of the forceps is not quite evident to me because the pelvis and all its diameters are apparently of ample size. Shortly after delivery a mass protruded from the vagina, and coincidently with it an incontinence of the bladder was also noted. The condition was at first looked upon as one of paralysis of the bladder and a good prognosis was given. The condition, however, did not improve, and after being seen by a number of consultants she finally came into the care of Dr. F. Lange, formerly of this city, who diagnosed for the first time a vaginal rupture of the bladder, with complete loss of the urethra and also an ununited fracture of the left pubic bone. Since that time the patient was operated on a number of times. I will mention here only those operations of a major nature:

The first major operation was undertaken December 30, 1895, and surprisingly was perhaps the one followed by the greatest amount

of success. It consisted in a closure of the defect of the bladder and the formation of a new urethra out of the left labium minus. After this operation the patient regained control of the bladder.

The second major operation was undertaken May 10, 1896. The previously mentioned vaginal protrusion, which the operator recognized as a hernia, was pushed back and the opening closed by some sort of a vaginal plastic. This operation was not in the least successful; the hernial protrusion recurred immediately, whereupon the patient was informed that before another attempt at its radical cure could be made it would be absolutely necessary to first repair the fracture of the pubis.

The third major operation was therefore undertaken in January, 1897. The patient was told that the ends of the fractured pubic bone were refreshened and sutured with silver wire. Unfortunately the wound became infected and had to be reopened. Intractable sinuses formed throughout the length of the incision until the silver sutures were removed about six months later; at the same time another unsuccessful attempt was made to cure the hernia by a vaginal operation. This may therefore be called the fourth operation.

A fifth unsuccessful attempt at a cure was undertaken in June, 1899.

Thereafter the patient abandoned all hope at a cure for nine years.

In 1908 the patient again became pregnant and was delivered prematurely by a breech presentation. After this confinement the hernia increased markedly in size; it also became evident, for the first time, that the hernia contained not only the bladder but also intestines. The patient was a total invalid; she became bed-ridden and suffered a great deal of pain and untold inconvenience from the hernial protrusion; a particularly annoying symptom was the inability to empty her bladder unless she first reduced the hernia manually.

She therefore readily consented to a sixth attempt at a cure, which was undertaken March 31, 1913, by Dr. Robert Abbe, to whom I am indebted for the following notes: This operation was the first attempt at a cure by the abdominal route. The hernia in the depth of the pelvis was exposed; its contents were found to be the bladder and about three feet of small intestines. These as well as the hernial sac were drawn back, and after putting the sac on the stretch to the utmost, the opening was repaired by a sort of cystopexy, the bladder being fixed by six sutures of Pagenstecher linen to the peritoneum and fascia of the anterior abdominal wall. For a while this seemed to fulfil the intended design; however, soon after the patient was permitted to be up and about the condition recurred.

I saw the patient for the first time May 15, 1913. My physical examination revealed the following status: A well-healed median abdominal scar. A protrusion in the left labium, about the size of an

adult fist was noted; this protrusion was dull on percussion and imparted an impression of translucency; it was reducible, but upon the slightest attempts at reduction the patient felt an uncontrollable desire to urinate. The swelling was so large that its mesial surface, having pulled the vagina down, was covered with mucous membrane. The introitus vaginæ was crescentic, with the convexity toward the right. The left labium minus was absent (result of previous operations). The vestibule of the vagina was so distorted that at first I was entirely unable to find any urethra; finally, after a great deal of search, I was able to discern an orifice or, better said, the opening of a fistulous tract high up, hidden underneath the symphysis, which on probing led in a tortuous manner upward and to the left into the bladder. The entire vagina was occupied by a protrusion which came down along its left side. When the mass was reduced there was to be felt to the inner side of the descending ramus of the pubis a longitudinal hiatus, easily admitting four fingers. The internal organs were negative to palpation.

The history and the physical findings were not very encouraging for a radical cure. The patient, however, was so willing, and even insisting, that I finally acquiesced to her pleadings and consented to make another attempt in a manner not hitherto tried.

This operation was performed May 27, 1913. Median laparotomy extending from the symphysis pubis to one inch above the umbilicus. Massive adhesions were encountered at the site of the last operation. After liberating the adhesions it was seen that the hernia was of the sliding variety, involving the left half of the bladder. This was very discouraging, because at the very outset it prevented me from at least extirpating in a thorough manner the hernial sac, as I had hoped to do. The small intestines were adherent in the depth of the sac and were freed.

The hernial ring was a large, irregular oval, easily admitting the folded hand, and was bounded externally by the ascending ramus of the pubis and mesially by the soft tissues of the bladder, uterus and vagina. The problem of a cure therefore resolved itself into the question of my ability to close this opening; neither pelvic fascia nor levator ani were available. I believe both were ruthlessly torn away at the original forceps delivery. I therefore deliberately carried out an operation I had evolved in advance, namely, to dislocate the uterus and to use it as a plug for the hernial opening.

In order to enable me to do so I first extirpated the right ovary and both tubes. After incising the pelvic peritoneum anterior to the left broad ligament the uterus was dislocated into an extreme sinistroversion and fastened in its new position with a number of Pagenstecher sutures to the descending ramus of the pubis. Had the uterus been only a trifle larger or the hernial ring only a trifle smaller it would have been possible to close the hernial ring completely; as it was, the lateral portion only could be obliterated, and no

matter what I did there still remained a weak area to the right of the dislocated uterus which could not be closed. The best I could do under the circumstances was to pull up the vagina and bladder and suture these organs to the dislocated uterus. The duration of the operation was two hours. The convalescence was exceedingly stormy; the patient vomited almost continually for a number of days. Temperature and pulse, however, remained normal. Primary union resulted and the patient was discharged June 19, 1913.

I kept the patient under observation, and for some time after the operation she was quite comfortable. However, about one year after operation I found on examination that the uterus was again in its normal vertical position, no more sinistroverted, and that there was again a hernial bulging. I heard from the patient the last time, just one year ago, at which time the hernia had recurred to practically its former dimensions.

As is seen I was not any more successful in curing the patient than my predecessors. This is due to a number of causes: (1) because my case was a traumatic one and that in consequence the hernial opening was of such dimensions that it simply could not be closed up with any one of the tissues normally present and normally available for the plastic part of the operation. It is on that account that I thought of utilizing the uterus, so to say, as a plug to stop up the hernial opening. It is true I finished the operation as originally planned, but already during the operation it was seen that the uterus was not large enough to completely close up the hiatus in the pelvic floor; no matter how the sutures were applied or how strongly the uterus was sinistroverted, there always remained a small opening anteriorly, which invited a recurrence. In addition subsequent events show also the fallacy of the operation, as the uterus did not stay permanently fixed in its new position, in spite of the fact that an unabsorbable suture material was used. Within a year's time the sutures had evidently cut through, as the uterus was found to have returned to its normal position. The mediocre ultimate result was, I believe, due to the extensive pelvic denudation, and deposit of cicatricial tissue.

Pudendal hernia is one of the rarest forms of hernia. After a careful search of the literature I have been able to find only the following valid cases:

Cooper,[1] in his treatise on *hernia*, devotes a special chapter to the subject of pudendal hernia, and describes the following two cases:

Case I (Cooper).—This case was a female, aged twenty-two years, who had a hernia, the size of a pigeon's egg, for a long time, and which she had always been able to reduce. When Cooper saw the patient he found a swelling, situated below the middle of the

[1] The Anatomy and Surgical Treatment of Crural and Umbilical Hernia, etc., London, 1807.

labium, while the upper part of the labium and the inguinal ring were free from any swelling. The tumor extended upward and alongside of the vagina, nearly as far as the uterine os. The hernia gave an impulse on coughing. Cooper succeeded in reducing the hernia by taxis; in doing so the hernia disappeared upward with a gurgling noise, with relief of all the symptoms. After reduction of the contents the labium was flaccid and a finger introduced into this flaccid sac could be passed upward into a circular orifice on the inner side of the ischium, between it and the vagina. Subsequently a T-bandage was used to retain the hernia.

Epicrisis. I have copied this history practically verbatim from Cooper. In spite of the brevity of the report there is not the slightest doubt that the case is a true case of pudendal hernia. It is regrettable that the anatomy of the hernial ring is not described in more detail.

Case II (Cooper).—This case is merely mentioned in connection with the former; the report of the same is even shorter. It also was in a female who had a tumor similar to but smaller than the preceding and situated in the right labium. It disappeared in the recumbent posture but reappeared promptly when the patient stood up. It dilated on coughing.

Even before Cooper's time I find recorded 2 cases which may have been cases of pudendal hernia. All writers upon the subject of pelvic herniæ in general quote both cases as perineal hernia; the description is not sufficient to enable me to decide the question definitely. For the sake of completeness I have deemed it best to include them in my list of cases, but have decided to at least signify my doubt in their validity with a question mark. The 2 cases are the following:

Case III (?) (Méry[2]).—The hernia was found in a female five or six months pregnant; it was somewhat larger than an egg and disappeared on compression. The contents were evidently bladder.

Epicrisis. Von Winckel includes this case in his list of pudendal herniæ. He, however, doubts the correctness of his action, as he adds that the description of the case is not sufficient to differentiate it from an ordinary vaginal cystocele.

Case IV (?) (Curade[3]).—The patient was a female, aged twenty-three years, who was six months pregnant. On examination a lateral perineal tumor was found which increased in size on standing or when the patient refrained from urinating for a long time. It was soft and painless. When compressed manually there arose a desire to urinate, and if pressure was continued urine was actually pressed out. After confinement the hernia disappeared, but it returned in

[2] Mém. de l'acad. royale des sciences pour l'annes, 1739. Original not obtainable. History is abstracted from Ribes. Dictionnaire des sciences médicales, xl, 384.

[3] Mémoires de l'acad. royale de chir., 1769, ii, 25.

a subsequent pregnancy. Curade states that he has no doubt that the case was one of perineal hernia.

Epicrisis. The case was either perineal or it was vesical; it could hardly have been both. The description of the physical signs and the findings are so accurate, however, and all point so strongly toward an involvement of the bladder, that I am more inclined to disregard the word perineal used in connection with the case and to place it among the pudendal herniæ.

Chronologically the next case to be reported is that of a contemporary of Cooper, and of a surgeon who has also done much to further our knowledge of the subject of hernia. I refer to Cloquet.

Case V (J. Cloquet[4]).—Under the title "Sur une Hernie Vulvaire" this author publishes the following case: The patient was a female, aged twenty-four years, who complained of a swelling in the vulva. On examination Cloquet found in the posterior part of the right labium majus a round swelling the size of a large chestnut, which stretched the overlying skin and also extended toward the inner surface of the external genitals; the swelling was slightly tender and extended upward alongside the vagina; it became much more tense on standing and coughing and gradually increased in size. The patient noticed a swelling for the first time only fourteen days previously, and she believes that it was caused by straining at her work and at stool. Cloquet was able to reduce the swelling by taxis, the reduction being accompanied by a gurgling sound. After reduction a finger could be invaginated into the labium, whereupon a rounded opening was noticed between the vagina and the ramus of the ischium. Nothing further was done, but the patient immediately felt relief of her symptoms, nor has the hernia recurred since.

Case VI (Hartman[5]).—This operator reports that he has performed an autopsy upon the body of a female who had suffered for a long time with symptoms of a vesical calculus. At the autopsy there was found a tumor in the labium which was formed by a prolapsed portion of the bladder.

Epicrisis. It is regrettable that exact autopsy findings are lacking in this case; on that account it is very difficult to differentiate it with precision from an ordinary cystocele.

Case VII (Hager[6]).—This surgeon, under the caption "Vorderer Mittelfleischbruch bei einem Weibe," describes the following case: The patient was a female, aged twenty-eight years. During her first confinement, which was very difficult, the patient noticed in the middle of the right labium majus a swelling the size of a walnut;

[4] Nouveau Jour. de méd. Redigée par M. Beclard, Chomel, etc. April, 1821, x, 427. Original not obtainable. History is abstracted after Ebner. Deutsch. Ztschr. f. Chir., 1887, xxvi, 101.

[5] Ephemerid naturæ curiosorum. Observatio 71. Original not obtainable. History is abstracted after Jacobson. Gräfe und Walther's Jour. d. Chir., 1826, ix, 399.

[6] Brüche und Vorfälle, Wien, 1834, p. 297.

it decreased in size in the recumbent posture but became larger on standing and walking; it was easily replaced but reappeared promptly. The swelling increased slowly in size during the subsequent four years and then increased suddenly and became painful and softer. Poultices were applied, whereupon the swelling opened spontaneously at two points, discharged a large quantity of blackish fluid and decreased in size. Seven months later, in the course of a second pregnancy, the swelling became more annoying, on which account the patient entered Hager's clinic. At the examination there was found a swelling the size of a pigeon s egg, which occupied the right labium majus. The labium majus had disappeared by being stretched over the tumor. The vagina was pushed over to the opposite side by the pedicle of the swelling, which passed upward between the vagina and the ascending ramus of the ischium. The swelling was very tense and elastic and both painful and tender. Hager diagnosed an anterior perineal hernia (pudendal) which was inflamed and also mildly incarcerated. Under local treatment these symptoms disappeared and finally the patient was discharged just prior to full-term delivery.

CASE VIII (Koenig[7]).—Speaking of pelvic herniæ, this author says that the most frequent form are those which descend alongside the vagina, in front of the transversus perinei, and then make their appearance upon the surface in the labium majus. He saw one such case, which had the size of a man's head. Detailed description is not given.

CASE IX (Von Winckel[8 9]).—In this case the patient was a female who had been confined a number of times; all deliveries were very difficult; the last time instruments (forceps) had been used. Even prior to this last confinement the patient noticed a swelling in the right labium majus. Upon the mesial surface of this swelling another smaller swelling formed, which also increased in size and made quite a projection. On examination a swelling larger than an adult fist was seen occupying the vulva, and more particularly the posterior part of the right labium majus. It was situated anteriorly and to the right of the perineal body, and was bounded externally by the tuberosity of the ischium and anteriorly by the right half of the symphysis pubis. Even on casual inspection it was seen that the swelling was made up of two different parts, namely, an outer one belonging to the labium and an inner one belonging to the introitus. On careful examination the smaller inner swelling was recognized to be the everted Bartholinian gland. In the larger portion, or hernia proper, various structures could be palpated. By manipulation and pressure along the right side of the vagina most of the hernial contents could be replaced into the pelvis; one smaller body, which was taken to be

[7] Lehrbuch der speciellen Chirurgie, Berlin, 1877, p. 201.
[8] Pathologie der weibleichen Sexual Organe, Leipzig, 1881, p. 282.
[9] Samml. klin. Vortr., No. 397.

the ovary, could not be replaced. Treatment with a pessary and a truss was tried first but was absolutely unsuccessful; von Winckel therefore tried a plastic operation per vaginam, which was followed by a slight improvement, but failed at a cure.

Von Winckel reviews the published cases of pudendal hernia and reports the following additional case.

CASE X.—This patient was a female, aged fifty-one years. At the age of twenty-two years, after being in labor for three days and after many attempts at delivery with forceps, she was delivered by perforation. At the age of forty-six years she noticed accidentally a swelling in the right labium, which gave rise to very few symptoms in the beginning, but did so subsequently. The swelling was reducible, and when reduced an opening could be palpated underneath the symphysis. Von Winckel made many attempts to treat the patient with a truss, but without avail, and in consequence he decided to operate.

The operation was carried out in the following manner: Through a median laparotomy it was ascertained that the intestines were so adherent to the sac that they could not be liberated; therefore the proposed closure of the sac from within the abdomen was abandoned and a ventrofixation of the uterus substituted. For a short while the condition was improved somewhat, but as a recurrence followed very soon the patient was operated a second time. At this operation the sac was split open from below, the contents were reduced and the sac obliterated by suture. The patient was greatly improved by this operation, but not cured completely; a small hernia still remained, which grew only slightly during the next fifteen years.

Von Winckel discusses pudendal herniæ from an etiological point of view and arrives at the conclusion that they are either acquired or congenital. As a case of congenital pelvic hernia he quotes the case of Lacoste.[10] The case was that of a child, aged one and a half months, that had a protrusion "through" the sacrum, opposite the second spinous process, about one and a half inches above the anus. It was the size of a walnut and became more prominent on coughing or crying. In the course of time the opening in the sacrum closed by bone and the hernia disappeared.

Epicrisis. I have deemed it preferable to exclude this case as a true case of pudendal hernia, owing to its meager description and also because I believe that both etiologically and anatomically the case was more likely a meningocele upon the basis of a spina bifida.

Fortified by this case von Winckel reports as a congenital hernia the following case of a male child who at the age of seven days presented alongside the left pubis and in close proximity to the scrotum, an elevation the size of a pigeon's egg, in which intestines were palpable and which were reducible. As in many other cases of

[10] Froviep's Noticen, 1823, iv, 223.

pudendal hernia this case also suffers from the fact that it is insufficiently described; at best it may be said that the case is not fully proved, and for that reason it might be better to exclude it. As it is the case would be the only case of a pudendal hernia in a male, the only one that occurred in a child, and the only one that occurred spontaneously.

A study of these 11 existing cases enables us to make the following deductions:

1. *Sex.* I have been unable to find a single authentic case of a pudendal hernia in the male. It must be said, however, that I do not accept as proved the case reported by von Winckel, which occurred in a male infant seven days old.

2. *Age.* The youngest patient recorded was aged twenty-two years (Cooper's Case I); the oldest patient recorded was aged fifty-one years (von Winckel's Case II), but this patient had had a hernia for a number of years before consulting a physician regarding her ailment.

3. *Side Affected.* In 5 cases the hernia was upon the right side; in 2 cases the hernia was upon the left side, while in 4 cases the side affected is not stated.

4. *Etiology.* Primarily, I presume all those factors which bear upon the etiology of every hernia must be considered to be effective also in pudendal hernia. In addition, however, pregnancy and parturition are evidently of considerable importance in the etiology of this particular hernia. We find, for instance, that in a goodly proportion of the cases it is distinctly stated that the hernia either began during labor, or was noted very soon thereafter. In a few of the latter it is particularly emphasized that the labor was very difficult and often also instrumental, so that the presumption is very strong that the act of parturition and the trauma coincident to it had something to do with originating the hernia.

5. *Surgical Anatomy.* A pudendal hernia makes its escape from the pelvis through an irregular triangular space, which, roughly speaking, is bounded laterally by the descending ramus of the pubis, and perhaps slightly also by the ascending ramus of the ischium, mesially by the vagina, and posteriorly by the transversus perinei. The latter muscle is a very important landmark, because it serves to differentiate a pudendal hernia from a perineal hernia. The space is marked off by three small muscles, namely, externally the ischiocavernosus, internally the constrictor cunei and posteriorly the transversus perinei. Even in a perfectly normal individual this space is a weak part of the pelvic diaphragm.

The internal approach to this space is also somewhat triangular and is bounded mesially by the uterus and bladder, externally by the round ligament, while the base is formed by the linea terminalis of the pelvis. This is approximately the surgical anatomy of a spontaneous pudendal hernia. We have seen, however, that a number of the

reported cases of pudendal hernia were traumatic in nature, the trauma being the act of parturition. What the exact nature of the trauma is it is rather difficult to determine in view of the absence of exact dissections. Judging merely from the nature of the resulting hernia the surgical anatomy can be only guessed at and appears to be a transversely running tear through the levator ani and its two fascial layers, just posterior to the symphysis pubis.

The organ which lies in closest proximity to and practically upon the surface before described is, in the first place, the bladder; it is on this account that we find in pudendal hernia so frequently symptoms referable to the bladder. The portion of the bladder resting immediately upon this space is covered only in part by peritoneum, so that the resulting hernia is usually of a paraperitoneal variety; the sac in consequence is hardly ever a complete one, and the greatest difficulty would be encountered were one to attempt to extirpate such a sac *in toto*. In the subsequent growth of the hernia other organs may find their way into the hernia, but it appears to me to be more than plausible that these would always rest upon the prolapsed bladder. An ovary was felt in the sac by von Winckel. I am of the opinion, however, that there is a greater likelihood of the ovary falling back into the cul-de-sac of Douglas, and that being the case it would be more likely to appear in a perineal hernia.

6. *Physical Signs.* A pudendal hernia usually makes its appearance in the posterior part of the labium majus. It is more or less globular in form and, owing to the frequency with which the bladder forms its contents, it gives one an impression of translucency. The one great characteristic of a pudendal hernia is that its superficial covering is made up of that part of the labium majus which is continuous with the mucous membrane of the vagina. The consequence is that the mesial half of the hernia is covered by mucous membrane and the outer half by integument. Even herniæ of very large size never involve the anterior portion of the labium majus; this is a very important physical sign, because it serves to differentiate this hernia at once from a large inguinal hernia, which has migrated into the labium. An inguinal hernia has a neck running up into the inguinal region and is always covered only by the cutanêous portion of the labium majus. Reduction in inguinal hernia occurs upward and outward in the direction of the external inguinal ring, while in the pudendal hernia it occurs in a direction parallel with the vagina.

On superficial examination a pudendal hernia is most likely to be confounded with a large cyst of the Bartholinian gland. The latter have an identical location, are covered by the same tegumentary structures and are also translucent; they can be readily differentiated, however, by the fact that all symptoms of a hernia otherwise are lacking.

It is hardly likely that a pudendal hernia will ever be confounded with a perineal hernia. It is true that the internal opening

of the two may be very close to each other; in fact, the two are separated from each other only by the transversus perinei. It might be said, therefore, that just when a hernia is in the formative period it would be exceedingly difficult to differentiate the two. In their subsequent growth, however, they take on an entirely different direction and appear upon the surface in widely different locations, namely, in the posterior part of the labium in the pudendal hernia and upon the buttocks in the perineal; there should therefore be no difficulty in differentiating the two herniæ at a stage of full development.

7. *Treatment.* No case of pudendal hernia is on record as having been cured. Of the 11 recorded cases only 2 have been operated, namely, Cases IX and X, both by von Winckel. The case reported by me is therefore the third case in which an attempt at a radical cure has been made by operation. Attempts by means of vaginal or labial plastics must be followed by failures, as no opportunity is given to follow up the two cardial principles underlying the radical cure of every hernia, namely, high ligation of the sac and a closure of the internal hernial ring. I am of the opinion that in spite of the difficulties which may be encountered this can best be attained by approaching the seat of the trouble by the abdominal route. It is perfectly possible, though not yet demonstrated, that in the spontaneous pudendal herniæ there is a well-defined ring, with firm enough structures surrounding such ring, *i. e.*, the levator ani and its superior and inferior fascial layers, which could be utilized for a plastic, with a fair promise of success. In the traumatic cases, however, the outlook for a radical cure is very meager indeed, as has been proved by my case also, in spite of the novel procedure attempted.

STUDIES IN CHOLELITHIASIS.

II. THE CLINICAL RELATIONSHIPS OF THE CHOLESTERINEMIA TO THE PATHOLOGICAL PROCESS.

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This communication will deal with the relationship of the cholesterin content of the blood to diseased conditions of the bile passages, the vast majority of these being accompanied by stone formation.

The individual blood determinations will then be compared with anatomical conditions present, and when complicating factors are present their significance will be discussed and the proper interpretation indicated. Finally, the clinical value of these laboratory determinations in the making of any individual diagnosis will be discussed.

The patients upon whom these studies were carried out were derived from the surgical services of Doctors Lilienthal, Beer, Berg, Elsberg and Moschcowitz at the Mount Sinai Hospital, New York. We are indebted to all of these gentlemen for their coöperation in this work.

As indicated above, no case has been included in this series unless an accurate anatomical diagnosis, made either at operation or autopsy, was available. Wherever more than one cholesterin determination was made before operation the figures given in the tables indicates an average. These figures are expressed in terms of milligrams of cholesterin for each 100 c.c. of blood. The methods employed in making the quantitative chemical estimations were described in the introductory paper of this series.

The first table details in a general way the essential facts in all of the cases studied without any attempt having been made to correlate the findings with the pathological conditions. In all of the following tables the symbols indicating the degree of jaundice are to be interpreted as follows:

\+ = subicteric tint.
++++ = very deep jaundice.
++ and +++ = intermediary degrees of jaundice.

TABLE I.

Case.	Cholesterinemia, mg. per cent.	Temperature, F.	Jaundice.
185	0.322	99.6	++++
267	0.125	101.2	
351	0.3075	100.0	
330	0.230	98.6	
202	0.2125	98.6	+
331	0.1925	101.6	
328	0.190	98.6	
184	0.2425	98.0	±
194	0.2725	102.6	
85	0.175	98.6	+
495	0.235	98.6	
143	0.200	98.6	
270	0.155	100.0	
240	0.170	100.4	
344	0.132	98.6	
302	0.125	100.4	
207	0.250	99.8	
265	0.200	99.8	
284	0.162	98.6	
260	0.209	99.0	
294	0.205	98.6	
106	0.2725	98.6	++

of the two may be very close to each other; in fact, the two are separated from each other only by the transversus perinei. It might be said, therefore, that just when a hernia is in the formative period it would be exceedingly difficult to differentiate the two. In their subsequent growth, however, they take on an entirely different direction and appear upon the surface in widely different locations, namely, in the posterior part of the labium in the pudendal hernia and upon the buttocks in the perineal; there should therefore be no difficulty in differentiating the two herniæ at a stage of full development.

7. *Treatment.* No case of pudendal hernia is on record as having been cured. Of the 11 recorded cases only 2 have been operated, namely, Cases IX and X, both by von Winckel. The case reported by me is therefore the third case in which an attempt at a radical cure has been made by operation. Attempts by means of vaginal or labial plastics must be followed by failures, as no opportunity is given to follow up the two cardial principles underlying the radical cure of every hernia, namely, high ligation of the sac and a closure of the internal hernial ring. I am of the opinion that in spite of the difficulties which may be encountered this can best be attained by approaching the seat of the trouble by the abdominal route. It is perfectly possible, though not yet demonstrated, that in the spontaneous pudendal herniæ there is a well-defined ring, with firm enough structures surrounding such ring, *i. e.*, the levator ani and its superior and inferior fascial layers, which could be utilized for a plastic, with a fair promise of success. In the traumatic cases, however, the outlook for a radical cure is very meager indeed, as has been proved by my case also, in spite of the novel procedure attempted.

STUDIES IN CHOLELITHIASIS.

II. THE CLINICAL RELATIONSHIPS OF THE CHOLESTERINEMIA TO THE PATHOLOGICAL PROCESS.

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This communication will deal with the relationship of the cholesterin content of the blood to diseased conditions of the bile passages, the vast majority of these being accompanied by stone formation.

The individual blood determinations will then be compared with anatomical conditions present, and when complicating factors are present their significance will be discussed and the proper interpretation indicated. Finally, the clinical value of these laboratory determinations in the making of any individual diagnosis will be discussed.

The patients upon whom these studies were carried out were derived from the surgical services of Doctors Lilienthal, Beer, Berg, Elsberg and Moschcowitz at the Mount Sinai Hospital, New York. We are indebted to all of these gentlemen for their coöperation in this work.

As indicated above, no case has been included in this series unless an accurate anatomical diagnosis, made either at operation or autopsy, was available. Wherever more than one cholesterin determination was made before operation the figures given in the tables indicates an average. These figures are expressed in terms of milligrams of cholesterin for each 100 c.c. of blood. The methods employed in making the quantitative chemical estimations were described in the introductory paper of this series.

The first table details in a general way the essential facts in all of the cases studied without any attempt having been made to correlate the findings with the pathological conditions. In all of the following tables the symbols indicating the degree of jaundice are to be interpreted as follows:

\+ = subicteric tint.
++++ = very deep jaundice.
++ and +++ = intermediary degrees of jaundice.

TABLE I.

Case.	Cholesterinemia, mg. per cent.	Temperature, F.	Jaundice.
185	0.322	99.6	++++
267	0.125	101.2	
351	0.3075	100.0	
330	0.230	98.6	
202	0.2125	98.6	+
331	0.1925	101.6	
328	0.190	98.6	
184	0.2425	98.0	+
194	0.2725	102.6	
85	0.175	98.6	+
495	0.235	98.6	
143	0.200	98.6	
270	0.155	100.0	
240	0.170	100.4	
344	0.132	98.6	
302	0.125	100.4	
207	0.250	99.8	
265	0.200	99.8	
284	0.162	98.6	
260	0.209	99.0	
294	0.205	98.6	
106	0.2725	98.6	++

Case.	Cholesterinemia, mg. per cent.	Temperature, F.	Jaundice.
222	0.176	99.4	+
226	0.190	98.0	
276	0.220	99.2	
148	0.212	99.0	
254	0.242	98.8	
166	0.190	99.0	
228	0.1475	101.6	
190	0.205	99.6	
263	0.1675	98.6	
181	0.110	102.4	
177	0.220	99.2	
94	0.150		
159	0.2975	98.6	
312	0.125	99.4	
306	0.190	100.4	
244	0.163	99.0	
433	0.1725	99.0	+
132	0.200		
1	0.238	99.8	++
384	0.2075	98.6	
199	0.161	99.2	
162	0.235	...	++
501	0.130	99.0	
250	0.235	99.8	
225	0.420	100.0	+++
272	0.162	99.0	
169	0.155	100.8	
343	0.250	99.4	++++
165	0.227	99.8	++
268	0.212	99.6	−
264	0.200	99.4	
179	0.205	99.0	
151	0.215		
127	0.237	...	+
269	0.230	102.0	+
382	0.175	99.8	
473	0.1575	99.6	
119	0.2375	99.0	+
126	0.200	98.6	+
128	0.1625	98.6	
195	0.176	100.2	
"S"	0.348	98.6	
273	0.1675	99.2	
134	0.290	98.6	
172	0.155	99.8	+
147	0.212	100.0	+
178	0.2725	103.6	++++
149	0.1328	100.4	++

In the following series of tables the cholesterin content of the blood is compared with the anatomical conditions present. These represent all of the pathological conditions one meets during the course of clinical, operating-room and autopsy experience. In practically all of the cases the macroscopic diagnosis of the conditions present have been verified and amplified by histological examination. These pathological conditions are as follows:

1. Gall-bladders which show a practically normal histological structure and contain usually a thin light colored bile or more rarely a viscid darker bile. Stones also are present varying in

number and size. The gall-bladder contents are very frequently bacteriologically sterile.

2. Gall-bladders frequently dilated and showing a normal or only a slightly abnormal histological structure and containing a single stone more or less impacted in the neck of the gall-bladder or in the cystic duct. The contained bile is very thin and watery. the bacteriological examination of the gall-bladder contents frequently gives negative results.

3. Large distended gall-bladders with walls of a normal thickness or somewhat thinned out, showing histologically more or less atrophy especially of the mucous membrane. The contained stones are numerous but lie loosely in the large amount of thin bile. Stones may also be present in the hepatic or common bile ducts and the ducts themselves may also be of larger caliber than normal. It may or may not be possible to cultivate bacteria from either the contained bile or stones, or from both.

4. Gall-bladders in which infection has taken place, containing a thin pus or more rarely a thick creamy pus with stones. The walls are thickened and edematous and the mucous membrane is very frequently gangrenous. Abscesses may be present in the wall of the gall-bladder or between it and the liver bed, or more rarely in the substance of the liver a short distance away. The stones contained may be numerous, indicating that conditions correspond to groups 1 and 2, with an added infection, or only a single stone is present, indicating that a hydrops, as described in group 2, has become secondarily infected. In all of these the cystic duct usually becomes shut off. Stones may also be present in any of the ducts.

5. Gall-bladders which have shrunken to less than their normal size and whose walls show a chronic productive inflammation, frequently with areas in which a more recent inflammatory reaction has occurred. The amount of pericholecystitis varies from a minimum to excessive degrees, in which it seriously hampers the necessary cholecystectomy. The contents of the gall-bladder may consist only of stones or bile which may or may not be purulent, or both of these; or thick emulsions of cholesterin, containing fragmentary stones, are present, and in which numerous cholesterin crystals can be seen under the microscope. When the cystic duct is open and a probe can be passed into the hepatic and common ducts the condition represents the end-results of groups 1, 2 and 3; when the cystic duct has been obliterated the condition is the end-result of group 4. It rarely happens that the scarring and contracture has advanced so far that only a short stump represents the gall-bladder.

6. Gall-bladders corresponding to those in groups 1 and 3, and with which there is associated a swelling of the head of the pancreas. Acute hemorrhagic pancreatitis of the fulminating type is not included in this group.

7. Empyemata of the gall-bladder without stone formation.

These are pure infections, and bacteria can always be cultivated from the gall-bladder contents.

8. Gall-bladders corresponding in structure to group 5 but without stone formation. These represent the end-results of those in group 7.

The results of the quantitative chemical determinations of the cholesterin content of the blood in these groups are detailed as follows:

TABLE II.—PATHOLOGICAL GROUP 1.

		Mg., per cent.
Case No. 263,	cholesterin blood content	= 0.167
94,	" "	= 0.150
312,	" "	= 0.125
172,	" "	= 0.155

The cases grouped in Table II show normal figures for the cholesterin content of the blood.

TABLE III.—PATHOLOGICAL GROUP 2.

		Mg., per cent.
Case No. 207,	cholesterin blood content	= 0.250
250,	" "	= 0.235

TABLE IV.—PATHOLOGICAL GROUP 3.

		Mg., per cent.	
Case No. 331,	cholesterin blood content	= 0.1925	
328,	" "	= 0.190	
143,	" "	= 0.200	
260,	" "	= 0.209	
276,	" "	= 0.220	
254,	" "	= 0.242	
166,	" "	= 0.190	
268,	" "	= 0.212	
179,	" "	= 0.205	
119,	" "	= 0.237	(jaundiced)
134,	" "	= 0.290	
147,	" "	= 0.212	(jaundiced)
177,	" "	= 0.220	
265,	" "	= 0.200	
151,	" "	= 0.215	

The cases grouped in Tables III and IV, corresponding to the pathological groups 2 and 3, are biologically of a similar order and therefore it is to be expected that the cholesterin content of the blood would show figures of approximately the same range. The figures are all high notwithstanding the fact that only two of all the patients in the series had obstruction in the common duct and were jaundiced.

TABLE V.—PATHOLOGICAL GROUP 4.

		Mg., per cent.	
Case No. 194,	cholesterin blood content	= 0.2725	(in puerperium)
240,	" "	= 0.170	
302,	" "	= 0.125	
284,	" "	= 0.1625	
148,	" "	= 0.212	
228,	" "	= 0.1475	
181,	" "	= 0.110	
384,	" "	= 0.207	(diabetic)
169,	" "	= 0.155	
264,	" "	= 0.200	(pregnant)
127,	" "	= 0.237	(jaundiced)
382,	" "	= 0.175	
128,	" "	= 0.162	
195,	" "	= 0.176	
178,	" "	= 0.2725	(jaundiced)
149,	" "	= 0.132	

This table represents the findings in pathological group 4. The cholesterin content of the blood in these cases shows a normal or subnormal range unless some complicating factor is present. The individual explanations for the hypercholesterinemia cases are as follows:

Case No. 194, patient in puerperal period.

No. 264, patient pregnant.

No. 127 and 178 had obstruction in the common duct.

No. 384, patient was a diabetic.

No. 148, we have no explanation for this last figure. Possibly some complicating factor had been overlooked or omitted from the clinical records.

TABLE VI.—PATHOLOGICAL GROUP 5.

		Mg., per cent.	
Case No. 185,	cholesterin blood content	= 0.322	(jaundiced)
267,	" "	= 0.125	
85,	" "	= 0.175	
495,	" "	= 0.235	
294,	" "	= 0.205	
222,	" "	= 0.176	
226,	" "	= 0.190	
190,	" "	= 0.205	(pregnant)
159,	" "	= 0.297	
306,	" "	= 0.190	(jaundiced)
199,	" "	= 0.161	
162,	" "	= 0.235	(jaundiced)
501,	" "	= 0.130	
272,	" "	= 0.162	
165,	" "	= 0.227	(jaundiced)
269,	" "	= 0.230	(jaundiced)
344,	" "	= 0.132	
270,	" "	= 0.155	
433,	" "	= 0.1725	

Table VI gives the findings for the cases in group 5. The figures vary. A few are normal but most are high. Some of the high figures are so because of complicating factors. These are as follows:

Cases Nos. 162, 165, 185, and 269 are high because of obstruction in the common duct.

No. 306 is high because of common duct obstruction plus a nephritis.

No. 190 was pregnant at the time of observation.

TABLE VII.—PATHOLOGICAL GROUP 6.

		Mg., per cent.
Case No. 202,	cholesterin blood content	= 0.212
132,	" "	= 0.200
225,	" "	= 0.420

The figures in Table VII are uniformly high.

TABLE VIII.—PATHOLOGICAL GROUP 7.

		Mg., per cent.	
Case No. 106,	cholesterin blood content	= 0.272	(jaundiced)
343,	" "	= 0.250	(jaundiced)
473,	" "	= 0.157	

TABLE IX.—PATHOLOGICAL GROUP 8.

		Mg., per cent.	
Case No. 184,	cholesterin blood content	= 0.2425	(jaundiced)
126,	" "	= 0.200	(jaundiced)

In Tables VIII and IX are the figures for the cases in groups 7 and 8. They are usually normal unless some complicating factor is present. All of the high figures given are due to a coexisting common duct obstruction due to inflammatory swelling.

DISCUSSION. Diseased conditions of the bile passages are very liable to become associated with or initiated by disturbances in the normal physiological processes of the cholesterin metabolism, and in accordance with the pathological activities are readily divided into two classes:

1. Those without gall-stone formation.
2. Those will gall-stone formation.

The diseased condition of the bile passages may have been initiated by a bacterial infection. It may remain a purely infective process or it may cause changes in the excreted bile, with subsequent stone formation; or, as pointed out in the first paper, there may be a primary disturbance in the cholesterin metabolism leading to a precipitation of stones and finding its inception most frequently during the physiological period of pregnancy. A quiescent period may then follow, and frequently this continues, with or without symptoms, for the remainder of that particular individual's life. Recrudescences may, however, occur, perhaps frequently repeated at irregular intervals, due either to repetitions of the physiological disturbances or to renewed or complicating infection, or to both,

and occurring either independently at different times or simultaneously at the same time. In these metabolic disturbances the bile passages undergo changes either mechanically, owing to the presence of stones which act as foreign bodies or as a response to the added bacterial infection, or to the combination of these two acting together or alternately at different times.

At any given moment the state of the blood's content of cholesterin is influenced on both sides of the normal range by associated conditions of the body which may have nothing in common with the physiological processes of the cholesterin metabolism and the interpretation of any blood determination must take into account these complicating factors. These are as follows:

1. The cholesterin content of the blood is lowered:

(*a*) By a diet which is poor in lipoids.

(*b*) By the occurrence of high temperatures.

2. The cholesterin content of the blood is increased.

(*a*) By a diet excessively rich in lipoids.

(*b*) By the presence of other diseased conditions especially atherosclerosis, diabetes and nephritis.

(*c*) During pregnancy. The hypercholesterinemia of pregnancy usually lasts for a variable period after evacuation of the uterus.

(*d*) By the presence of obstruction in the common bile duct. If the obstruction, however, is not absolute, as indicated by the degree of the accompanying jaundice, the cholesterin content of the blood may not be increased. This is illustrated in Table X.

TABLE X.

	Mg. per cent.		Temperature F.
Case No. 185, cholesterin	= 0.322	(jaundice) ++++	99.6
202, "	= 0.2125	+	98.6
184, "	= 0.2425	+	98.0
106, "	= 0.2725	++	98.6
222, "	= 0.176	+	99.4
244, "	= 0.163	+	99.0
1, "	= 0.238	++	99.8
162, "	= 0.235	++	100.0
225, "	= 0.420	+++	100.0
343, "	= 0.250	++++	99.4
165, "	= 0.227	++	99.8
127, "	= 0.237	+	
269, "	= 0.230	+	102.0
119, "	= 0.2375	+	
126, "	= 0.200	+	98.6
172, "	= 0.155	+	99.8
147, "	= 0.212	+	100.0
178, "	= 0.272	++++	103.6
149, "	= 0.132	++	100.4

In the classifications given in the first half of this paper the individual tables seem to show a uniformity in the cholesterin contents of the blood for each group of cases, when all of the complicating factors detailed above are properly taken into account. The only

apparent discrepancies would be found in the cases grouped in Table VI (pathological group 5). The explanation of these apparent discrepancies lies in the natural history of these disturbances.

During our studies it has become increasingly evident that the subdivisions into groups attempted above is artificial and that these groups form a continuous progression. This has already been hinted at in describing these groups. The biological sequence of events may be one of three:

1. The pure infections illustrated best in groups 7 and 8 (Tables VIII and IX). The element of the cholesterin metabolism does not enter unless there is a complicating obstruction in the common bile duct. Only in that contingency does the cholesterin content of the blood range high. The complicating obstruction is due to swelling in the duct or to inflammatory swelling or adhesions about the duct. The affection begins as an empyema of the gall-bladder, and when repeated recrudescences of infection are permitted it terminates in the contracted and shrunken gall-bladder of group 8 (Table IX).

2. The cases that have their origin in disturbances in the cholesterin metabolism. Most often these disturbances in function are initiated by the physiological changes which accompany pregnancy. The hypercholesterinemia of pregnancy may reach such a degree that the accompanying supersaturation of blood and bile is rectified to the normal by a precipitation of stones in some portion of the bile passages, almost always the gall-bladder. This immediately furnishes the explanation for the patients with normal gall-bladders containing stones, the cholesterin contents of whose bloods are normal. At some time previous to the observation there had occurred a hypercholesterinemia which had been restored to the normal by a precipitation of stones. No further hypercholesterinemic crisis having occurred, these patients have had symptoms due to the mechanical effects of the stones acting as foreign bodies and have submitted themselves to operation at this stage. It is to be expected that the cholesterin content of the blood of such patients would be normal at the time of operation.

The original factor which had caused the hypercholesterinemia may continue, however, or may be repeated at intervals, so that at the time of observation the cholesterin content of the blood is relatively high. These are conditions exemplified in group 2 (Table III) and to a large extent in group 3 (Table IV).

3. Combinations of infection and disturbed cholesterin metabolism may occur either simultaneously or alternately and with different degrees of intensity. Depending on the factor which is paramount, or the stage of the process, or the presence or absence of complicating factors, which now become numerous, the cholesterin content of the blood is found to be below the normal, at the normal or much above the normal range. These cases are illustrated in groups 2, 3, 4 and 5 (Tables III, IV, V and VI).

The apparent discrepancies in the figures given in Table VI (group 5) are now explainable. This group represents the end-results of several other groups and the cholesterin content of the blood is found to vary as these do.

From the foregoing facts it must be conceded that in any given case the diagnostic value of any determination of the cholesterin content of the blood is a variable and dubious one. One can summarize those gall-bladder conditions in which the cholesterin content of the blood is normal as follows:

1. In the presence of stones in a normal gall-bladder, without common duct obstruction and with or without high temperatures.
2. In the presence of a chronically inflamed gall-bladder containing stones without common duct obstruction and with or without high temperatures.
3. In the presence of any of the above with incomplete obstruction of the common bile duct.
4. In the presence of an empyema of the gall-bladder, with or without stones, with low or high temperatures and with no obstruction in the common duct.
5. In conditions as in the preceding division (4), with partial or complete obstruction of the common duct.

The finding of a hypercholesterinemic condition, while usually pointing to some disturbance in the cholesterin metabolism and in the bile passages, is always subject to correction in the presence of any of those complicating factors, mentioned in the early part of this discussion, which, by themselves, are capable of increasing the cholesterin content of the blood. And when this correction is to be made it becomes difficult, if not impossible, to decide whether the entire excess of the cholesterin in the blood above the normal is due wholly or only in part to these complicating factors. The situation becomes all the more complex when it is known that it is possible to obtain hypercholesterinemic figures in other diseased conditions, some of which are herewith illustrated:

TABLE XI.

Case No.	Cholesterinemia, Mg., per cent.	Diagnosis.	Temperature, F.
224	0.190	Neurosis	98.6
243	0.265	Diabetes	98.0
369	0.200	Tuberculosis	100.2
317	0.2625	Carcinoma of liver	102.0
534	0.220	Colloid goiter	99.0
215	0.200	Nephritis	98.6
214	0.190	Nephritis	98.6
283	0.205	Phlebitis of leg	
"S"	0.325	Carcinoma of stomach	98.6
"R"	0.200	Sepsis	100.4
"TR"	0.250	Gastric ulcer	
"SW"	0.220	Chronic appendicitis	

The occurrence of a hypercholesterinemia can be used as a diagnostic factor in only one circumstance. When a distinction must be made between the jaundice due to cirrhosis of the liver and the jaundice due to common duct obstruction the finding of a hypercholesterinemic condition indicates that obstruction is present. Cirrhotic conditions uniformly give low figures for the cholesterin content of the blood.

Such a state of affairs goes to show that with gall-bladder conditions the proper interpretation of any cholesterin determination is only possible after a knowledge is obtained of the actual anatomical conditions. Only then is one enabled to reason backward and deduce the natural history of the actual pathological disturbance which underlies the entire disease. Such knowledge will then furnish scientifically correct and adequate data upon which a rational method of treatment may be based.

WAR MEDICINE

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THE WORK OF THE BUREAU OF TUBERCULOSIS IN FRANCE—AMERICAN RED CROSS.

BY WILLIAM CHARLES WHITE,
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WHEN the name of tuberculosis is called, those that gather for conference represent many curious stages of modern life. The large percentage of those interested are those who have come in contact with it in some intimate way or those who make their living by it, with, finally, but a small group of those interested in it as a purely scientific medical problem against which they try their brains year after year with but a minimum of success. But today it has for the first time in the history of the world come forward as one of the important problems of the wastage of man power, and so has been dignified by a new situation in its relation to the

armies of both sides. America was awakened to it by the public press which published story after story of the decimation of the French forces by this disease, and though little was said about it, save in the more technical journals, we know today that the armies of the other countries were suffering in much the same way. The French Government itself was aroused to take active steps for the provision of its soldiers with tuberculosis, and America at the same time began to raise money to help in what was reported to be such an appalling situation.

In France the Service de Sante of the Army, under Monsieur Justin Godart, Sous-Secretaire d'État, established by the end of the third year of war numerous hospitals for soldiers with tuberculosis called "Hôpitaux Sanitaires." They were largely composed of the sanatoria which, through private sources, had been providing for the civil population before the war and of former convents and schools which were utilized and turned into housing places for the consumptives. Already fifteen years before the war there had been formed by the Department of the Interior a permanent committee charged with the problem of controlling tuberculosis. In 1915, however, when the question became more acute, a new powerful central committee was formed, with the chief object of collecting and distributing funds gathered for the care of discharged soldiers with tuberculosis and further of coördinating the work of the departmental committee which had been given the direct work of dealing with these soldiers after their release from the army and Department of Interior hospitals. In addition to this the Department of the Interior in October, 1915, received permission of the government to establish a credit of 2,000,000 francs, which was raised to 5,000,000 francs in 1917. This money it used in the opening of thirty Stations Sanitaires to receive the soldiers on discharge from the Hôpitaux Sanitaires of the army and in assisting the departmental committees in the home care of these cases after their discharge from the Stations Sanitaires.

In addition to this there existed a private organization in Paris known as the "Tuberculeux de la Guerre," with Mrs. Edward Tuck as its president, Mrs. Edith Wharton as its vice-president and Mr. Blair Fairchild as its secretary, which undertook to provide a number of sanatoria for the same group of soldiers reformed on account of tuberculosis. A large part of the money for this work was raised in America, especially in Boston, through the efforts of Miss Sally Fairchild, and in New York, through Mr. Walter Maynard.

During the time that these organizations were performing their tasks the Rockefeller Foundation sent Dr. Herman Biggs to France to make a study of the situation and to report on the advisability of this Foundation undertaking an antituberculosis campaign under its supervision. As a result of Dr. Biggs's report, a com-

mission was formed, with Dr. Farrand as its director, Dr. James Alexander Miller and Dr. Selskar M. Gunn, as associate directors, who were commissioned to come to France and undertake, in coöperation with the French, a campaign against tuberculosis. Shortly before the consummation of this commission, America had entered the war and the American Red Cross announced its drive for $100,000,000 for assistance in connection with the war in France. One of the chief appeals which it made to the people of America was for assistance in the field of tuberculosis and in preparation of its plans in carrying out this work. Mr. Homer Folks was asked to take charge of its crusade against tuberculosis, and was later made an assistant director of the Rockefeller Commission. Upon his arrival in France, in the early days of July, Major Murphy, commissioner for the American Red Cross for Western Europe, invited Mr. Folks to take charge of the whole of the work of the Department of Civil Affairs. Mr. Folks accepted this position and appointed Dr. William Charles White, who had come to France in June to take charge of the work of the Tuberculeux de la Guerre, to the position of the Chief of the Bureau of Tuberculosis. Dr. White was also made an associate director of the Rockefeller Commission. In this way all the American effort in the tuberculosis campaign in France was carefully correlated and started on its mission.

The first task was a division of labor between the Red Cross and the Rockefeller Foundation, so that their efforts would contemplate a uniformity of results. The Rockefeller Commission undertook a study of the conditions existing, the provision of dispensary service, an educational campaign and the selection of two units—one an arrondissement of Paris and another a department of France—in which it would provide a model organization to be used as an object lesson in American methods.

The Red Cross Bureau of Tuberculosis undertook the more immediate fields of the work, such as the provision of hospitals, improvements of conditions in temporary hospitals, assistance to French organizations dealing with tuberculosis and a careful study of the whole tuberculosis situation in France, which might be used in conjunction with the Foundation's work for a permanent program and lasting evidence of the work of America.

This article will deal mainly with the work of the Bureau of Tuberculosis. To present it clearly I have divided the subject into the following divisions:

1. Provision of new beds in existing French institutions.
2. Improvement of conditions in existing French institutions.
3. Provision of new hospitals for the civil population, conducted entirely by the Red Cross.
4. Coöperation with the Rockefeller Commission.
5. The establishment of a hospital admission bureau.

6. Provision of hospital for American soldiers.
7. Provision for Serbs.
8. Its permanent work of departmental reconstruction with its preliminary survey and subsidy as the basis of its future lasting effort in France.

Provision of New Beds in Existing French Institutions. Bligny Sanatorium. One of the suggestions of Dr. Biggs's report was the completion of the sanatorium at Bligny near Paris. This sanatorium at the beginning of the war already had provided by its excellent modern buildings for about 200 patients and had under more or less complete construction provision for about 350 more patients. In 1914, however, all building work in France was dropped, and where busy workmen had been employed, idleness and disuse became apparent. Grass grew about and covered the materials for construction; the iron and forges rusted and the parts of the building which should have been covered, being exposed to wind and weather, suffered from slow disintegration. Those buildings in use were later taken over by the Service de Sante of the army for the use of soldiers with tuberculosis, under Dr. Guinard, who was the medical director of the institution, and its use for the civil population was discontinued. It was in this condition that we found it in September, 1917, and following Dr. Biggs's suggestion, it was considered wise to undertake completion of those parts of the institution which were most nearly ready for occupancy. After a conference with the Service de Sante and the board of management of Bligny, visits to the institution with the architect, Mr. Vaudoyer, and our own construction department under Mr. William Emerson, it was found that an appropriation of 406,000 francs would complete the building and provide for 250 more tuberculous soldiers. Much of the material required for this completion was available under the former contracts, either on the ground or in the workshops of the contractors. This provided for the closing of the windows of the building, the completion of the tiling, the central heating plant, the equipment of the kitchen, the dining room and the terraces. The arrangements were finally consummated and work started toward the end of September, with the hope that by January patients would be admitted to the institution. This, however, did not reckon with the difficulties of construction work in France today, and it was not until March that these beds were ready for use. It was, however, perhaps as well, because in March the great new German offensive began and Bligny Sanatorium was able to take 150 soldiers—wounded and tuberculous—from a hospital evacuated because of the drive against Montdidier.

Hôpital St. Joseph. Shortly after the work was started at Bligny, Dr. A. H. Garvin, assistant chief of the Bureau of Tuberculosis, and Dr. Wyatt, in charge of the dispensary work of the

nineteenth arrondissement under the Rockefeller Foundation, found in the fourteenth arrondissement of Paris a very keen interest in the tuberculosis problem on the part of the board of management of the Hôpital St. Joseph. This institution, which is one of the largest and best hospitals in Paris, had purchased an old convent with its adjoining garden and had plans under way for reconstructing the building and utilizing it for tuberculosis hospitalization, with wards for men and women, a dispensary service, a recreation hall and day camp in adjoining buildings. The dispensary was to be conducted in conjunction with home visiting work. The war stopped all of its plans.

After consultation with the board of management it was found that if the Red Cross would contribute 285,000 francs, Hôpital St. Joseph would be able to add 208,000 francs for the completion of the building and thereby secure 250 more available beds for the civil population in and around Paris. The details of this arrangement were finally consummated.

As a result, however, of this gift a great step forward has been made in the partitioning of Paris for intensive dispensary work, for it has been possible to secure the hearty coöperation of the administration of Hôpital St. Joseph in an attempt so to divide the city that the tuberculosis work will be uniform and the different institutions dealing with the problem not overlap in their activities.

Improvement of Conditions in Existing French Institutions. In the first few months of our work in France it became apparent that the tuberculous portion of the population fell into six more or less well-defined groups, for the care of some of which new organizations had been started. These six groups are as follows:

1. Soldiers who were still under the jurisdiction of the Service de Sante of the army and cared for in the hôpitaux sanitaires. On October 31, 1917, there were 8879 of these for which the Service de Sante had provided 6521 beds in 37 hospitals. This group was composed of those who might still be of service to the army upon improvement in health.

2. Discharged soldiers of the second class whose connection with the army was completely severed and who were known as "Reformés No. 2." From August 2, 1914, to October 31, 1917, there were 80,551 soldiers discharged from the army on account of tuberculosis, and the Department of the Interior undertook to provide for their care by means of stations sanitaires and comites departementaux. The former by 3000 beds accepted patients for three months from the hôpitaux sanitaires; the latter provided individual assistance after their discharge.

3. The third group was composed of the rapatries. These rapatries were that portion of the population which had been engulfed by the German advance into France and Belgium, and being no longer of any economic service to Germany—the diseased

of all kinds, the old, the children, the maimed and disabled—were sent back into France. Among them were a large number of tuberculous. For the care of this group practically no provision had been made in the summer of 1916.

4. The fourth group was composed of refugees who fled before the German advance. These became naturally quickly merged in the civil population, but were taken by various organizations as separate groups, to which were given additional food, clothing, furniture and medical care. Among them also were numbers of tuberculous, and they were packed in the various cities and towns in the worst sort of sanitary conditions in any available buildings which could be made rapidly ready for their reception. No provision was made for the care of this moiety of the population.

5. The fifth group was the whole civil population of France. Practically all the institutions that had been available for them before the war were now utilized by the Service de Sante of the army, and there was nothing available for the women, children and old men suffering from tuberculosis.

6. The sixth group was composed of the refugees from other nations, chiefly Serbians and Belgians. For these France did her utmost with a generosity characteristic of her attitude, but naturally with her other burdens all she could do was inadequate.

A careful survey of the field indicated that the direction in which the Red Cross assistance could best be given was to those with whom France was having the greatest difficulty. These groups were the completely discharged soldiers, many of whom had now no longer any families, having been drafted from the devastated regions, the rapatries, the refugees, the civil population and the foreign refugees.

With the main objective of leaving the assistance in the hands of the French who had already been organized for these various purposes, the Bureau of Tuberculosis undertook to assist the existing French organizations and hospitals for the care of the above groups. The first opportunity was presented after seeing the conditions in seven sets of barracks which had been provided by the assistance publique in connection with the large hospitals and almshouses in Paris. These barracks were temporary structures of wood and had been provided for completely discharged soldiers—Reformés No. 2—but the conditions in them were such that from lack of food and insufficient equipment the patients would not remain long. There were available in this way 1052 beds, of which only 174 were occupied. It was felt after examining them that with diet kitchens, recreations rooms, additional clothing and materials to brighten their aspect, such as bed covers and flowers, that these beds might be filled up and a division of the Bureau under Mademoiselle Noufflard, a Frenchwomen who had already won the Croix de Guerre for her services at the Front, was created for this purpose. The success of the work of Mademoiselle Noufflard and

her assistants has been remarkable. Not only has she increased the number of tuberculous patients in the barracks from 174 to 657, thus providing for the segregation of this many more consumptives, but she has been able to exert a marked influence for good on the whole policy of the assistance publique in its relation to the tuberculosis problem. New construction in the shape of cure halls, dining rooms and recreation rooms were provided by the Red Cross and at St. Antoine by Mrs. H. B. Duryea, of New York. Additional nurses were also provided at the expense of the American Red Cross.

Institutions for Tuberculosis in the Rest of France. Immediately following this division of the work for Paris a new division for institutions dealing with tuberculosis outside of Paris was created with a triple object in view:

1. To assure the French people that the American Red Cross had the desire to help in the situation.
2. To help the patients already in hospitals suffering from tuberculosis.
3. To gather an inventory of the equipment already possessed by France for the war against tuberculosis.

This new division was begun under the supervision of Dr. Garvin, the assistant chief of the bureau, and four visitors were started on a tour, department by department, over the whole of France. These visitors found that tuberculous patients were housed in the following types of institutions:

1. Hôpitaux sanitaires.
2. Stations sanitaires.
3. Hôpitaux mixtes (which formerly were civil hospitals, but now take military and civil cases).
4. Hôpitaux complementaires (annexes to military hospitals).
5. Sanatoria.
6. Hospitals for bone and gland tuberculosis.

These provided 11,000 beds for tuberculosis of all kinds for a population of 39,500,000 people, with a total death-rate from tuberculosis in 1913 of 84,443. Many of these institutions required additional bedding, additional food and additional equipment, which the American Red Cross undertook to furnish at a cost of approximately 100,000 francs a month. It utilized, however, this assistance as a means of gaining an accurate knowledge upon which to base its future constructive work. Each visitor was given a questionnaire, carefully prepared by Dr. Baxter, assistant chief, and Miss Laws, secretary of the bureau, to be filled in under the following headings:

1. General information.
2. Admission requirements.
3. Administration and employees.
4. Physical condition of buildings and grounds.

5. Structural needs.
6. Improvements in general service for present needs.
7. Desirability of institution as a factor in departmental needs.
8. Miscellaneous local tuberculosis institutions and associations.
9. Municipal information in general.
10. Summary and recommendation.

These general headings were divided under numerous subheadings, as for instance, under Physical Condition of Buildings and Grounds, were considered wards, sanitation, ventilation, heating, disinfection, toilets, general surroundings, etc.

As each of these reports came back to the office it was carefully analyzed and utilized as a basis for the future proposals which will be considered under the heading of "Departmental Organization" later in this article. Through this division of the work, assistance was given in five months to approximately 12,000 tuberculous patients.

A second field of work in connection with the French institution, of which there have been a number of examples, is exemplified by the assistance given to the Hôpital d'Ormesson. This was the first hospital in France for the care of tuberculous children. On April 15, 1916, it opened one of its buildings for 160 tuberculous soldiers by an arrangement with the Service de Sante for three francs per day per patient. It soon found its deficit amounted to about 10,000 francs a month, and it was unable to continue, and so notified the Service de Sante. After visitation to the hospital and seeing the excellent work that was done, an agreement was reached between the hospital board and the Service de Sante that the American Red Cross would make up the deficit and so continue the use of the 160 beds which would otherwise have been unavailable.

The Bureau of Tuberculosis was also able to help Mademoiselle Chaptal, one of the pioneers in tuberculosis work in France, to procure through her organization, by a gift equal to the amount contributed by it, a hospital of 40 beds for tuberculous women of the civil population. This type of work continues from time to time and is considered an excellent method of securing permanent provision of beds under stable organizations.

Provision of New Hospitals for the Civil Population. It soon became apparent that the most urgent need in France was the provision of institutions for the tuberculous members of the three groups of population—civil, rapatriated and refugee mentioned above. For these France had been able to do very little during this time of emergency. The Bureau of Tuberculosis, therefore, undertook to assist in this field.

It chose as its field of operation the two largest centers of population, Paris and Lyons. It received the offer from the Department of the Seine of certain properties known as Hachette and Malabry,

which this department had purchased before the war for the construction of cheap houses for working people, by a plan known as the "Garden City Plant." This work, under the direction of Henri Sellier, whose conception it was, was arrested by the beginning of the war. Mr. Sellier, however, was interested in the whole tuberculosis problem and offered the properties, free of rent, to the Bureau of Tuberculosis, to be utilized for the housing of consumptives of the refugee and repatriated portions of the population. Mr. Sellier had formerly offered the property to Mr. Brissac, Sous-Secretaire of the Department of the Interior, and to Dr. Leon Bernard, of the Comité National d'Assistance aux Anciens Militaires Tuberculeux, but owing to lack of funds it could not be used by them. After a conference with all parties concerned it was finally turned over to the Bureau of Tuberculosis of the American Red Cross, and under the direction of Dr. James L. Gamble the work of rehabilitation of the building was commenced, utilizing for the labor a group of American and English Friends.

The two properties given by the Department of the Seine for this work comprised in all about 150 acres of ground, with three large houses and a number of outbuildings. The Bureau of Tuberculosis was able to secure in the immediate neighborhood also two other large houses, rent free, for the purpose of enlarging the number of patients whom they could accommodate. Work of reparation was started on the main building toward the middle of November, and on Christmas Day following the first three refugees with tuberculosis was admitted. This number increased week by week until at the present time there are about 150 women and children refugees in the institution. The future plans for this whole property, to which the name of Edward L. Trudeau has been given as a fitting name, both to honor the greatest American physician in the tuberculosis world and to bring about a feeling of unity between the two countries based upon Dr. Trudeau's French origin, contemplate the following different groupings of people: A sanatorium for women, a detention house for entering children, a hospital for tuberculous children, a preventorium for children of tuberculous parents and a colony for families with a tuberculous member from which the sick one cannot be separated. With the completion of the project, approximately 2000 persons in which tuberculosis is a common factor will be cared for. The work is being carried out in coöperation with the Department of the Interior of the French Government, the dispensary service is of the Rockefeller Foundation and our own Hospital Admission Bureau. The economic value of gathering these various functions of the bureau in the same immediate region near Paris, its source of supply of patients, is an important one, solving many of the difficulties of transportation and central administration which are serious even in peace times but much magnified under the present war conditions.

The colony plan, or "school for housing," as it has been called, merits perhaps a paragraph of explanation. It is a new implement in the field of tuberculosis stimulated by an emergency and following somewhat the lines of the Home Hospital Plan of New York City, but in a much more economic way. Miss Helen Knight Smith, formerly of the Home Hospital Service, and Mr. John Kincaid are at the present time developing this plan. The necessity for it arises from the homeless population which comes from behind the German lines. Many of these have tuberculous members which they refuse to give up, having already lost other members through segregation by the Germans. If these were allowed to go with their tuberculous member into the housing conditions provided for repatries it would mean, naturally, many chances of infection of other portions of the population. They all, moreover, have a keen desire to return to the regions from which they have been evacuated as soon as the war is ended. They are thus a displaced and transient population. The plan of the home colony contemplates taking them during the transient period in small houses specially constructed for the care of an individual tuberculous member. Each house is composed of three rooms—two sleeping rooms and a living room—with a small porch for the consumptive member. Each family will perform its own household duties, the children will be occupied in open-air schools, those members able to work will be given vocational training, based upon the vocations most likely to enable them to earn their living when they return to their homes, such as gardening, carpentry, tailoring and shoemaking, all families will be under careful intensive instruction in hygienic living, the expenditure of the family budget, cleanliness and citizenship. Amusements will also be provided through voluntary work by those who are interested in this field. The details of this plan need not be further elaborated here, but if it be successful for the necessity which compels it, it will undoubtedly be feasible for many of our large city problems for tuberculous families at home, both from its economic aspect and from its educational value, for without question the domiciliary care of the consumptive now looms as one of the most important factors in our war against tuberculosis.

Asile Ste. Eugenie. A simpler project is under way in the next largest center of population—Lyons. Here by coöperation with the Hospice Board which controls a number of the hospitals of the city of Lyons the Bureau of Tuberculosis received, rent free, a large hospital building and five barracks for the housing of rapatries and refugees—women and children—suffering from tuberculosis. This hospital, under the charge of Lieutenant Bellis, U. S. M. R. C., was opened in November, 1916, with provision for 210 patients. A good deal of reconstruction, painting and cleaning had to be undertaken, but this was accomplished with great rapidity through the combined efforts of the Hospice Board and the Red Cross.

Lyons, situated as it is on the direct line from Evian through which the rapatries enter France, forms a sort of clearing house for the tuberculous portion of this group. The Asile Ste. Eugenie works in conjunction with the French Bureau for the Care of Rapatries and with the committee of Lyons which has their distribution in charge. The food and its preparation, the laundry and the equipment are all provided by the Hospice Board, the Red Cross paying a *per capita* rate per day per patient of between three and six francs based upon the cost to the Hospice Board itself. The Red Cross receives from the French Government 2.75 francs to 3.25 francs for the care of each case which it cares for, thus reducing its actual expense of operation. The Red Cross in addition provides the medical care and most of the nursing. It is planned at the present time to increase the work at Lyons to assist that portion of the civil population which is not at the present time permitted to enter the Asile Ste. Eugenie.

Coöperation with the Rockefeller Commission. As mentioned above the plans of the Rockefeller Foundation were formulated on the basis of a long-distance view of the best permanent general organization for the war against tuberculosis in France. At the beginning of its work it was necessary for it to take a very careful survey of the whole situation, and it was consequently unprepared to do the immediate types of work found to be necessary. Wherever it was necessary, however, to give additional equipment in the nineteenth arrondissement of Paris or in its model Department of Eure-et-Loire or in its educational campaign, the Bureau of Tuberculosis accepted with interest the responsibility of providing the things desired. This assistance consisted of appropriations for dispensary construction, appropriations for educational pamphlets and assistance in the provision of hospital beds.

The Hospital Admission Bureau. With the publicity which heralded the work of the Rockefeller Foundation and the American Red Cross in the field of tuberculosis in France the requests for assistance for individual cases became a prominent factor almost from the first day of our arrival in France. This was more pronounced, inasmuch as the work of the Bureau of Tuberculosis commenced by the acceptance of an already-going concern, the Tuberculeux de la Guerre. It was soon apparent that some special division must be established for the handling of these cases, and in conference with Dr. Miller a division known as "The Hospital Admission Bureau" was made a part of the Bureau of Tuberculosis, since this Bureau had mainly to do with this work from the hospital side. The Hospital Admission Bureau was put in charge of Miss Shackford. Special cards were drafted by Mr. Dorlet, both for admission to the institutions and later follow-up work in the dispensaries upon the discharge of the patients from the institutions.

The Hospital Admission Bureau then undertook to get in cor-

respondence with all the hospitals dealing with tuberculosis in France which had been recorded through our Division of Hospital Relief, to arrange with them for the acceptance of cases recommended by our bureau on the payment of the *per capita* cost of the institution accepting them. This *per capita* cost ranged from 4.5 to 6.5 francs per day. The Hospital Admission Bureau from December 25, 1917, to April 18, 1918, had arranged for the placing of 759 cases of tuberculosis. It is hoped that this division of the bureau will grow into a permanent implement to be left in the hands of the French who up to our coming here had not been familiar with it, and that it will continue of great service in bringing the hospitals and dispensaries into close coöperation with each other. It has of course as one of its functions to place the proper types of cases in the institution suited for them and to see that cases are not lost track of upon their departure from the hospitals. It will also be the beginning of central registration of living tuberculous cases which has not existed prior to this time in France.

Provision of Hospital for American Soldiers. After studying carefully the question of the relation of tuberculosis to the various armies that had been fighting for the first three years of the war it was decided that the American Army, no matter how careful the exclusion of tuberculosis cases in the draft, would still have to deal with a group of cases which would develop tuberculosis from existing lesions not possible of diagnosis in the examinations given prior to conscription. It was thought that this was a field of work in which the American Red Cross could render assistance to our own army here in France. It seemed quite obvious that there would appear certain pneumonic types of tuberculosis, certain acute miliary cases, some severe hemorrhagic cases, many acute pleuritic cases with effusion, and probably a number of cases with tuberculosis in other parts of the body than the lungs. It seemed quite clear, too, that it would scarcely be fair to these individual cases if acute in type to follow the general order of the army and send them home. With this thought in mind an offer was made to the army headquarters to provide a hospital to work in conjunction with the hospitals of evacuation near the shipping ports in which the Red Cross would be given permission to take care of such cases needing hospital care prior to their return home. The medical division of the army after looking into the problem found that as early as December the need for such an institution was already apparent and the offer has been accepted. The Bureau of Tuberculosis will, with the utmost speed at its command, undertake the provision of a hospital near Bordeaux, which will then be turned over to the army for its administration in the care of these acute types of cases. As the need grows it is hoped that a similar institution may be provided for the hospital at Savenay,

where most of the tuberculous soldiers are cared for at the present time in tents.

The Problem of the Serbians in France. One of the earliest problems presented to the American Red Cross was a request for assistance for tuberculous Serbian refugees in France. No exact figures could be found upon which to base such assistance, and yet there was apparently a great need to be dealt with. After searching in every available office of the Serbian representations in France and of the French Government, there was still not enough data upon which to start work. Consequently the Bureau of Tuberculosis started a division for the study of the Serbian question under Dr. Francis Georger and later Mrs. John Knox Freeman. A visit was made to all the Serbian camps in France and arrangements made for the examination in our various dispensaries of the Serbians thought to have tuberculosis. This work took a great many months, but as a result of it a complete report of existing conditions among this group has been compiled and a recommendation made for the provision of a hospital for the care of tuberculous Serbians. The French have done their utmost to help the Serbian situation, but were unable to take care of the tuberculosis situation except by the admission of a few cases to the French military hospitals. The following statistics will sum up the situation as we found it: There were 17,285 Serbian refugees in France; of these were found 400 actually tuberculous, only 32 of which were receiving sanatorium care. It is hoped that the hospital for tuberculous Serbs will be under way before the close of April.

Departmental Reorganization. The task of orienting themselves by those who came to France in the summer of 1917 to undertake the reorganization of social conditions in a foreign country with an environment and background of a world war was a very difficult one. Their mental attitude was at first one of constant comparison with the conditions at home and possibly a desire to reproduce here the organization which had been evolved in our own country. Gradually, however, the fact that it was a wholly different problem was borne in upon them.

France had a democratic central government different in many aspects from that at home. She had never approached the tuberculosis problem by governmental control prior to the war, and the work had been done mainly by voluntary organizations. The central government had changed five times during the period of the war, which left little opportunity for a permanent policy.

France is divided into departments somewhat similar to our States, with the fundamental difference, however, that the prefects, who correspond to our governors, are appointed by the Ministry of the Interior and not elected by the people. This made local autonomy in health matters under the prefect difficult. In some

large centers of population the mayor is more powerful than the prefect of the department, and by virtue of being a senator in the central government or a former minister as well as mayor he may take precedence in authority in a way not likely to occur at home. In addition to this the war made a very strong War Department which overshadowed the Department of the Interior. The latter, however, had to accept the main burden of the tuberculosis problem. Then as at home large numbers of voluntary organizations had undertaken the task of raising money and making some provision to handle the sick in hospitals and dispensaries.

The effort to steer a judicial course in this situation became more and more a task requiring the greatest tact. The mere gift of aid to those who were suffering already from tuberculosis in their homes or assistance to existing institutions was obviously not enough. There constantly presented itself to the minds of those charged with the direction of this work the demand for some definite plan to pursue with the object of leaving in the hands of the French themselves an organization which would be stable and arranged in such a way as to bring about the best results under governmental control. It was obviously impossible to do it through a changing central government.

After studying the situation, however, for many months, it was finally decided that if the work could be begun in the departmental units and a proper organization established for each department the correlation of these at a later time would probably be a comparatively easy thing. When this conclusion was reached the rearrangement of our knowledge on this basis was begun. Carefully prepared cards on which was tabulated the general knowledge gathered from each department, division of department, city or town were printed under the following headings:

Population.
Total deaths.
Deaths from tuberculosis.
Estimated living cases.
General death-rate.
Tuberculosis death-rate per 1000 from the latest available figures.

Then in two columns was shown a theoretical equipment for the control of tuberculosis under such conditions and a recommended program upon which it would be safe for the Red Cross to carry on the work with its available funds. On the back of the card was a list of the hospitals, sanatoria, dispensaries, institutions and organizations already existing. A subtraction of this latter list from the recommended program naturally formed a lead at least as to what should be done in each region. This conception finally came to be the main field of work of the bureau.

The Department of Indre-et-Loire may be taken as a typical example of the method pursued. The division of the French Red

Cross Society known as "Secours aux Blesses Militaires," with the Comte de Pourtales as the district director, appealed to the Bureau of Tuberculosis for assistance in providing a hospital for tuberculosis at Tours. There existed already, however, in that department a Comité Departemental charged with the care of the reformés, a dispensary and a day camp under other organizations. Upon the first visit of Monsieur de Pourtales he was asked if it would be possible for him to undertake the bringing together of these various organizations into one single group which would undertake, under the direction of the prefect, the handling of all tuberculosis problems in the department, and further to see what amount of money the various organizations could contribute toward a definite program. He was promised that if the organization could be consummated the American Red Cross would be willing to assist in an equal amount whatever they were able to do themselves.

With this beginning and after later conferences in Tours and Paris, the desired results were finally attained and the Red Cross agreed to give 250,000 francs toward the provision of a hospital under the following terms: That the new committee take steps to organize the existing dispensaries under its general supervision; that it plan and install other dispensaries throughout the department; that it employ salaried trained visiting nurses for the dispensaries to organize and supervise the visiting work in the various communes; that plans for providing hospital beds for advanced cases be undertaken and that the American Red Cross pledge itself to assist in this work and the other needs of the department as they arose.

In March, 1918, with the knowledge tabulated for most of the other departments in France and the success obtained in Indre-et-Loire, a new division of the Bureau of Tuberculosis was created under Mr. Frank E. Wing, who in conjunction with Dr. Alexander Bruno, of the Rockefeller Foundation, undertook the work of visiting France, department by department, with the object of proposing to them a similar plan. They began in the Departments of Loire Inferieure, Ille-et-Vilaine, Cotes-du-Nord, and Finistere. They are to visit each organization having to do with tuberculosis, such as the prefects and mayors, the comités departementaux, the three branches of the French Red Cross and all voluntary organizations dealing with tuberculosis, suggest the necessity of their coming together in a central group to accept the responsibility of all the work of the department, and as an incentive to them to do this the Bureau of Tuberculosis proposes to give them such assistance as it is able in dispensary and hospital equipment. This work will probably consume the greater part of a year or longer, but as a result it will leave a lasting impression of the American effort in France with the control of the tuberculosis problem in permanent hands in such a way that the work will continue after the necessity for the withdrawal of the American assistance.

The accompanying map prepared by Dr. Drolet will give some idea of the condition in the different departments from the stand-point of tuberculosis mortality in the year 1913, in which the last figures for such a computation were available.

It is, in general, the plan of the bureau to go first into the blackest areas, which are those in which the mortality has been highest. This work is being carried out in full coöperation with the Rockefeller Foundation, which, if the plans mature, will continue the work after the Red Cross assistance has been discontinued. The spirit in all of this work exemplifies a determination to make the assistance given to France in this epoch of her history the best expression of America's interest in the burden which she has carried so long. It is one in which all personalities have been suppressed and only an ultimate of what is best for France and her condition considered, and it is the hope of all who have been interested in it that it may meet the purpose for which the funds in America have been contributed.

The Ration and the Requirement of Food for Children.—PFAUNDLER (*München. med. Wchnschr.*, 1918, lxv, 173). In October, 1917, the civilian ration for the population of Münich contained 56.7 grams of protein, 30.5 grams of fat, 308 grams of carbohydrate and had a fuel value of 1760 calories. It was constituted as follows: Bread, 285 grams; potatoes, 500 grams; egg, 6.4 grams; meat, 35 grams; sugar, 28.6 grams; butter, 10 grams; milk, 250 c.c.; cheese, 15 grams; grits, 15 grams. The cereals contained 26 grams of the total protein, meat 7.7 grams, milk and cheese 11.7 grams, and egg 0.8 gram. This ration was not materially changed from October to January, 1918. The ration for children in the second year of life was the adult ration and $\frac{3}{4}$ liters milk, 7.1 grams sugar, 15 grams cakes, 21.4 grams grits—in all 83.4 grams of protein, 58.2 grams of fat, and 375 grams of carbohydrates, with a fuel value of 2410 calories. Pfaundler states that this is too high a value and its reduction in the following years of the child's life has had bad results and led to many complaints. Children in the third and fourth years of age received the adult ration plus 500 c.c. of milk—in all 71.7 grams of protein, 48 grams of fat, 330 grams of carbohydrates, with a fuel value of 2082 calories. Children in the fifth and sixth years received the adult ration plus 250 c.c. of milk, containing in all 64 grams of protein, 39.5 grams of fat, 319 grams of carbohydrate, and 1920 calories. After six years of age children received the normal adult ration of 1760 calories. Pfaundler gives curves of the nutritive requirements of children of various ages compiled from von Pirquet, Schlossman, Cammerer and others, showing, for example, that a child of fifteen may require 2450 (von Pirquet) or 2000 calories (Cammerer) per day, and he recasts the ration for children as follows:

Age of children.	Münich ration, October, 1917.	Pfaundler's recommendations.
1 to 3 months	943	
4 to 12 months	1133	
2d year	2410	1550
3d and 4th years	2082	1550
5th and 6th years	1920	2070
6 to 16 years	1760	2070

Pfaundler hopes that his recommendations will be followed in the interest of the rational nutrition of children. He notes that from February 4, 1918, school children of seven to fourteen years of age were given half a liter of skimmed milk in the place of a quarter of a liter of whole milk, thereby increasing the calories by 40, but reducing the quantity of butter fat. The expected improvement in the condition of the school children was not achieved by this procedure. [If it were not for this article it would appear to the abstractor incredible that the official food control of Münich, the town in which Carl von Voit had lived and taught in the fourth year of the war, should have been so ignorant as to the food requirements of children.] G. L.

The Composition of Meat under Various Conditions of Nutrition.—DIESSELHORST (*Pflüger's Arch.*, clx, 522) finds that the chemical composition of the protein structure in the muscle is independent of the

nutritive condition of the animal. The analyses are based upon the muscle substance free from fat glycogen and ash. When a dog was given rice the relation between nitrogen and carbon (N. C.) in the muscle substance was 1 to 322, and when given meat in large quantity the relation was 1 to 323. In another dog when fasting the N. C. ratio of the muscle was 3 to 188 and after partaking of a mixed diet in large quantity the ratio was found to be 1 to 3185. G. L.

Barley as a Food Material.—RUBNER (*Arch. f. Physiol.*, 1917, p. 339) says that wheat, rye and barley when milled to the same degree show little difference in absorption except that the protein in rye is a little less digestible than the protein in the other two cereals.

G. L.

The Treatment of Wounds by Flavine.—PILCHER and HULL (*British Med. Jour.*, February 9, 1918) after an experience with more than 5000 cases treated by flavine, are confirmed in their good opinion of it as time passes. They have found that for ease of preparation and application, rapidity when dealing with large numbers of cases, early cleaning of wounds and abatement of constitutional reaction to absorption, flavine (and its congener brilliant green) is an admirable application under all circumstances, but especially when surgeons are few, time is short, and wounds are many. No special technic is required, for after adequate previous surgical treatment any dresser can fill the wound cavity with gauze dipped in 1 in 1000 solution of flavine. In none of the cases under observation has skin irritation been observed. It has been clinically apparent in a few cases only that there is a certain amount of surface destruction in the wounds. In these cases a fibrinous pellicle forms, perhaps due to the use of too concentrated solution. This pellicle is readily removed by the application of saline solution, and also it is found that the addition of hypertonic saline solution to the antiseptic is useful in producing free exudation. W. H. F. A.

Observations upon Prognosis of Irritable Heart of Soldiers.—LEWIS (*Lancet*, February 2, 1918) outlines some results of the method employed in sorting those soldiers for duty who have been admitted to hospital for cardiac disabilities. All soldiers admitted to the Military Heart Hospital are submitted to a full physical examination, and within the first few days of their stay all cases presenting unequivocal signs of mitral stenosis, aortic disease, aneurysm or material cardiac enlargement are recommended for discharge as permanently unfit. On the basis of former experience are now also eliminated those who give a clear history of repeated or recent attacks of rheumatic fever, who show very high rates of heart beating or complain of severe precordial pain accompanied by hyperalgesia. All are eliminated in whom a positive decision can be reached, none are eliminated in regard to whom a divergence of opinion may exist. The whole remainder is submitted to graduated exercises and marches, and the reactions to these exercises form the chief basis

upon which the military prognosis eventually relies. The system has been in operation for two years, and during this period about 3000 patients have been studied, the average stay in hospital being between two and two and a half months. Between May and November, 1916, some 558 cases, who had successfully passed the preliminary examination intended to eliminate the obviously diseased, were discharged from hospital. It is with this group of men, especially the consideration of their after-histories, that the present report deals. Of this group of 558 men 286 were regarded as permanently unfit or placed in the sedentary class and the remaining 272 were classified for duty. Of these 86 have passed overseas within shorter periods than eleven months. A further number, 30, were in provisional units by the end of this period. Of the men going overseas it is estimated that more than half reach the firing line. These figures may be taken as representative for invalid soldiers suffering from so-called "irritable heart" and treated and sorted by a system of graded exercises. Lewis concludes from these analyses of after-history that the method has been highly successful, and urges its applicability to all convalescents from acute and subacute illnesses, medical and surgical. It is especially useful in reaching a decision as to health or unhealth in soldiers occupying the borderland between health and disease. The method is fully described in the recent Special Report Series, No. 8, of the Medical Research Committee's Report.

W. H. F. A.

REVIEWS

MODERN UROLOGY. By HUGH CABOT, M.D., F.A.C.S., Chief of the Genito-urinary Department of the Massachusetts General Hospital. Two volumes. Pp. 1452; 632 engravings and 17 plates. Philadelphia and New York: Lea & Febiger, 1918.

THE well-known editor of this work, consisting of two volumes, comprising the composite authorship of twenty-nine men identified with urology, has placed before the profession a treatise which must occupy a foremost place among the modern books on this subject. One is reminded of Morrow's great *System of Genito-urinary Diseases, Syphilis and Dermatology*, or Frisch and Zuckerkandl's peerless classic of three volumes on the subject of *Urologie*. It is not true, as the editor alleges, that none of the surgeons contributing to Morrow's *System* were specialists; moreover, it is a fact that a number of the contributors to the present volume, namely, Baer, Squier, Lower and Buerger, are general surgeons. Certainly this additional experience in nowise detracts from their reputations as urologists qualified to write authoritatively. The editor's avowed intention has been to give articulate expression to American urology. It might be questioned whether eighteen-twenty-ninths of this resides in Boston and New York.

Cabot himself recognizes the inherent weakness of composite authorship leading to a work of two volumes. This is specially pertinent in realization that in such a treatise syphilis has been divorced, except in so far as it concerns the genito-urinary apparatus. As a text-book for students, any two-volume work necessarily is destined to lose popularity comparatively with a single volume. On the other hand, irrespective of the conflict of opinion, duplication of matter, as evidenced in the chapter on diseases of the urethra in the female, in which the consideration of gonorrhea is largely a redundancy, in view of the foregoing treatise on gonorrhea in the male, also the duplication of certain well-known engravings and a certain loss of balance tending to disjointedness, the work makes a strong appeal to both practitioners and specialists.

The first volume opens with an historical sketch of genito-urinary surgery in America, which is most interesting and instructive. The cystoscope and its use by Buerger is a classic. Chapters on methods of diagnosis, roentgenology, and syphilis of the genito-urinary organs are followed by sections devoted to the penis,

urethra, scrotum, testicles, prostate, and seminal vesicles. The second volume is limited exclusively to the diseases of the bladder, ureter, and kidney.

Great credit is due the editor for so well balancing and proportioning the component chapters of the work. The chapters on obstruction and cancer of the prostate, urinary calculus and malformations of the bladder are exceptionally commendable. In the chapter on bladder tumors the reviewer takes exception to the term "malignant papilloma," and believes that when a papilloma becomes malignant it ceases to be a papilloma and becomes a carcinoma. Likewise, the term "unipolar" should be discarded in conjunction with electric currents; there is no such thing. In the same chapter there appears a disproportion in the number of illustrations as to treatment and pathology. Likewise the chapters on diseases of the penis and stricture of the urethra are strikingly devoid of illustrations. Exception must also be taken to the advocacy of "spinal anesthesia with tropacocain (1 c.c. of 5 per cent. solution) in preference to general anesthesia as an efficient and useful means for making an examination of the female urethra or for treatment of urethral conditions in cases impossible to examine under local anesthesia."

The consideration of and space devoted to the fourth venereal disease, "erosive and dangerous balanitis," is very timely and commendable and could not have been better or more authoritatively presented.

The reader is frequently impressed by quotations *in extenso* of authorities when he would prefer to learn the writer's own experience. It might be argued that inadequate consideration is given to the organic and inorganic constituents of the urine in health and disease or that the work would be enhanced by a chapter on nephritis. Few urologists still attribute much of a role to tonsillitis as a cause of ureteral stricture. Again, the critic must take exception to the statement relative to indigo-carmin as a functional kidney test that "for accurate estimation of renal function its position has been superseded." Partiality is obviously evident when three times the space is given to phenolsulphonephthalein as to all other functional kidney tests of elimination. We must also deplore the teaching or necessity of ureteral catheterization of the supposedly normal kidney for diagnosis and the best treatment of renal tuberculosis. Recourse to the use of some functional kidney test not dependent upon ureteral catheterization—as indigo-carmin by the method of chromo-ureteroscopy—would almost invariably obviate the necessity of resort to "operation for purposes of diagnosis" in difficult cases of descending urological or renal tuberculosis.

The merits of Cabot's *Modern Urology* so far transcend its demerits that detailed criticism would appear to be hypercritical and unjustifiable. The work is an enviable achievement, and is

destined to be a perennial monument to the expert professional attainments of its editor and collaborators. The character of the printing and illustrations, the quality of the paper employed and the excellent binding are merely additional evidences of the customary high-class work of the publishers. P. A. T.

THE PRINCIPLES OF HYGIENE. A PRACTICAL MANUAL FOR STUDENTS, PHYSICIANS AND HEALTH OFFICERS. By D. H. BORGEY, A.M., M.D., D.P.H., Associate Professor of Hygiene and Bacteriology, University of Pennsylvania. Sixth edition. Pp. 543. W. B. Saunders Company, 1918.

As the author states, this book has been prepared to meet the needs of students of medicine, public health officers and students in architecture in comprehending the principles on which modern hygienic practices are based and also the sanitary requisites in ventilation, heating, water supply and sewage disposal. No one is better qualified to write on these subjects than Dr. Borgey. The material is handled in his usual concise manner, which adds so greatly to the value of the book. However, the progress in the application of the principles of hygiene is so rapid, both in civil and army life, that it is difficult to keep pace in these days of our great war, so that even between editing and publication of such a treatise many new applications are presented.

The first six chapters of the present edition cover air, ventilation, heating water, sewage and garbage disposal. Then follows a long chapter on food and dieting, surprisingly well covered in such a space. A chapter on exercise is excellent. Next is discussed clothing and personal hygiene, and the usual points are brought out. The chapter on industrial hygiene is altogether too short and in nowise adequately covers this most important, if not the most important, field for the practical application of the principles of hygiene. Comprehensive mortality tables are given for the various trades, and some mention is made of the causes of this mortality. Little is said, however, of the effect of the several industries upon women as compared with men, and nothing at all on the effect on the birth-rate or the health of the children of working mothers.

The chapter on school hygiene contains a fund of information and chapters on military and naval hygiene are full; but of course there will be much more to be said on these two phases of the subject after the war is over.

Chapters on soil and habitation follow, and then two chapters on the vital causes of disease and on disinfection. It is easy to appreciate that these two chapters are written by an authority on the subject. The volume ends with chapters on quarantine, quarantine regulations and vital statistics. C. N. S.

APPLIED BACTERIOLOGY. By C. H. BROWNING, M.D., D.P.H., Director of the Bland-Sutton Institute of Pathology, Middlesex Hospital. Pp. 291. London: Henry Frowde and Hodder & Stoughton, 1918.

ONE of the most interesting and important recent developments in bacteriology concerns the properties of certain antiseptics and their use in the isolation of bacteria, especially the value of brilliant green and telluric acid in fluid medium in the isolation of typhoid-paratyphoid bacilli from feces in the diagnosis of intestinal infections or "enterica" as they are now comprehensively termed. This little book presents an excellent review of the researches of the author and his colleagues in this important field, together with a review of the more important papers by others on this subject, so that conclusions are based upon the work of trained and critical independent observers. Chapters are also devoted to the isolation of Bacillus diphtheriæ and diphtheroids by means of a simple medium containing telluric acid; the selective action of thallium acetate and thorium nitrate upon Bacillus pyocyaneus and organisms of proteus type and ultra-violet rays upon Bacillus coli communis, Bacillus typhosus, meningococcus and acid-fast bacilli; the chemistry and practical application of certain antibody reactions are briefly considered, with special reference to the aid they give in the diagnosis and differentiation of bacterial species, and the book ends with a brief chapter upon the clinical and bacteriological aspects of tetanus, based mainly upon recent experiences with this infection in the present war.

The title of the book leads one to expect a wider discussion of the practical applications of bacteriology, but in its limited scope the subject matter is presented in an excellent manner and should prove of much value to laboratory workers and also to those concerned with the clinical and administrative aspects of medicine, especially those engaged in army and municipal work. J. A. K.

SURGICAL CLINICS OF CHICAGO, VOL. II, NO. 1 (FEBRUARY, 1918). By NUMEROUS AUTHORS. Pp. 226; 73 illustrations. Philadelphia and London: W. B. Saunders Company, 1918.

THE reputation of the preceding numbers of this publication is maintained by this one. The subjects range from the common interesting conditions, like duodenal ulcer treated by Andrews, to those which are rare and interesting, like gall-stone ileus, discussed by Bevan. Between these extremes we have a large list of surgical affections and operations handled by competent Chicago surgeons,

as a rule, with lucidity and brevity. For examples, we have radium in gynecology by Watkins; urethral strictures by Eisendrath; arthroplasty by Hessert; conservative surgery in children by Carl Beck; a large group of orthopedic cases by Parker and osteo-arthritis by Ridlon. The variety in the method of presentation of the wide range of conditions helps to maintain the deserved popularity of this surgical journal. T. T. T.

HAND-BOOK OF OPERATIVE SURGERY. By WILLIAM IRELAND DE C. WHEELER, Lieut.-Col., R. A. M. C., Surgeon to Mercer's Hospital. Third edition. Pp. 355; 226 illustrations. New York: William Wood & Co., 1918.

THIS small volume, as its title indicates, is devoted to the common surgical operations, particularly of civil life. Ligations and amputations fill one-third of the book. Local anesthesia, direct transfusion of blood, the common deformities of the legs and feet, tendon transplantation and bone-grafting are briefly considered. An attempt is made to provide an introduction to the type of operation confronting the inexperienced practitioner in military and civil hospitals. It is an excellent book for the field it aims to supply.

T. T. T.

MANUAL OF SPLINTS AND APPLIANCES FOR THE MEDICAL DEPARTMENT OF THE UNITED STATES ARMY, 1917. Pp. 208; 173 illustrations. New York: Oxford University Press.

A BOARD of medical officers was appointed for the purpose of standardizing certain medical department supplies. The best guarantee of the character of the work is the board itself: Lieut.-Col. William L. Kellar, M. C.; Major Robert B. Osgood, M. R. C.; Major Alexander Lambert, M. R. C.; Major Joseph A. Blake, M. R. C.; Captain W. S. Baer, M. R. C., and Captain Nathaniel Allison, M. R. C. This manual does not aim to be a complete treatise but to put into the hands of the military surgeon a practical time-saving guide, in which the text-book has been subservient to graphic illustration. T. T. T.

PROGRESS
OF
MEDICAL SCIENCE

SURGERY

UNDER THE CHARGE OF

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Treatment of Gunshot Wounds of the Knee-joint.—Page (*British Med. Jour.*, September 1, 1917, 282) bases his study upon an analysis of 70 cases submitted to operation. Thus all cases with clean perforating wounds remaining clean coming under observation in the same period are omitted. There was articular bone injury in 59, the missile lodged in 51, recovery occurred without obvious infection of the joint in 45, amputations were done in 10, the deaths occurring after amputation were 4, and the total deaths 5. In dealing with wounds of the knee-joint the natural defensive powers of the part against infection should be borne in mind. To obtain fair play for the defense should be the aim of the surgical procedures adopted. Primary prophylactic (that is within twenty-four hours of injury) operations should be radical, and secondary operations undertaken on account of progressing infection, should, short of amputation, be planned on conservative lines. The expectant treatment of wounds of the knee-joint is only justifiable in the case of typical perforating injuries due to a rifle bullet. All wounds of the joint caused by shell fragments or distorted bullets should be considered as primarily infected. The primary prophylactic treatment should consist in the removal of any foreign bodies present and in the excision of the whole wound tract at the earliest possible time after injury. Any delay beyond twenty-four hours will entail failure in a certain proportion of cases. The results at present are particularly bad in cases in which gross comminution of the diaphysis is present. A primary excision or erosion of the joint (within twenty-four hours) would probably improve the results in such instances by preventing the development of entomyelitis. Repeated aspiration of the joint and the intra-articular injection of any of the antiseptics in use are calculated to prejudice the natural defense. It is safest to leave some drainage along the wound tract after operation for a few days, certainly when bone injury is present. Any infection then left may

become localized in the same way as occurs in the case of the peritoneum. A gauze wick makes a satisfactory form of drain. Immobilization of the joint during all critical periods is essential. An interrupted plaster-of-Paris splint affords the best means of effecting this. When general infection of the joint has taken place, treatment by fixation, lateral arthrotomy, and immunization gives the best chance of saving the limb, secondary abscesses are to be expected and should be evacuated after their complete development. Neither cross-section and flexion of the joint nor secondary excision of the knee are sound procedures.

Injuries to the Peripheral Nerves and Their Treatment.—MOYNIHAN (*Surg., Gynec. and Obst.*, 1917, xxv, 595) says that the earliest examination should be made of all wounds in which division of a nerve trunk is probable. If at the casualty clearing station such a lesion is found, end-to-end sutures should be adopted forthwith. This is most likely to be possible in cases in which primary suture of the wound, after excision, is found practicable. If secondary suture of the wounds after the Carrel-Dakin method has been employed, is to be undertaken the union of divided nerves should be secured at the same time. If these methods have been attempted and have failed they do not prejudice the later union of the nerve. On the contrary, they probably ensure that an easier and more satisfactory operation can then be practised. Throughout the whole period before late nerve suture is attempted the strictest attention must be paid to the relaxation and nutrition of all paralyzed muscles, to the maintenance of suppleness in all joints moved by these muscles and to the preservation of the integrity of the skin. Operations upon nerve trunks demand the most scrupulous observance of the ritual of asepsis. There must be the greatest gentleness of manipulation; the nerve must not be injured by instruments or by the surgeon's finger; it must not be separated from its sheath or disturbed overmuch from its bed; it must not be chilled or allowed to dry. All sutures must be of fine catgut and introduced with most punctilious accuracy. Axial rotation of the nerve must be avoided. The cut ends of the nerve before approximation must show clearly the fibers of which the trunk consists. Nerve-grafting is of little or no value; nerve anastomosis is to be sharply condemned; the turning down of flaps from the nerve to bridge a gap is useless. Tendon transplantation is of great value when nerve suture is impossible or when suture has given a result not entirely satisfactory.

Gunshot Wounds of the Lungs and Pleura.—MOYNIHAN (*Surg., Gynec. and Obst.*, 1917, xxv, 605) says that the approximate mortality from gunshot wounds of the chest at all parts of the line of communication is 20 per cent. The causes of death are hemorrhage, as a rule, within twenty-eight hours, and sepsis after the third or fourth day. The local conditions in wounds of the chest wall and lung are in all respects similar to those met with in wounds elsewhere. The missiles are the same, their destructive effects upon the tissues are the same, and the infecting organisms are the same. The lung tissue is more resistant to attack than many other tissues. The opening of the pleural cavity and the resulting exposure of a large serous sac to infection and all its consequences add, however, a danger of the most threatening character. The chief essential in the treatment of all cases of penetrat-

ing wound of the chest is rest. In clean, perforating wounds of the chest, rest, together with the cleansing and dressing of the wound of entrance or exit, will lead to the recovery of the great majority of cases. In cases of "open thorax" the earliest and most complete effort possible must be made to secure closure of the wound after an appropriate toilette. In those rare cases of grave hemorrhage when hemoptysis is present or when the blood escapes by the wound a direct access to the source of the bleeding must be obtained, when all contingent circumstances permit, and the wound in the lung must be treated by suture, preferably, or by plugging of the cavity from which the blood escapes. In cases of hemothorax, when the blood effused is small in quantity and remains sterile, no active measures are necessary unless absorption is long delayed. Aspiration, repeated if necessary, may then be performed. In cases of hemothorax, when the blood effused is large in quantity and sterile, aspiration after the seventh or eighth day, or earlier in cases of urgent dyspnea, certainly hastens convalescence, permits a more rapid expansion of the lung, and prevents the formation of adhesions which may permanently cripple the free movements of the lung. In cases of hemothorax whether the amount of blood is small or large, when infection takes place, open operation is necessary. Early operation, both when the Carrel-Dakin technic or Morison method are adopted, saves many weeks of convalescence and permits of a more perfect functional recovery, Small foreign bodies, or rifle bullets, embedded in the lung, often cause no symptoms; they become encapsulated and may safely be left. Larger foreign bodies retained in the lung may cause distressing or disabling symptoms for long periods. In such cases removal after resection or elevation of the fourth rib through an anterior incision will allow of the safe removal of the projectile from any part of the lung. Pieces of metal so removed are almost always infected.

Gunshot Wounds and Their Treatment.—Moynihan (*Surg., Gynec. and Obst.*, 1917, xxv, 583) says that perfect mechanical cleansing, that is, the excision of all contaminated, infected or dead parts, the removal of all fragments of clothing (by far the most important of all causes of continuing infection in a wound) and of all projectiles, is the supreme necessity in all cases. In early cases this may allow of immediate closure of the wound, which will be followed by healing in the great majority of cases, say in 80 per cent. or perhaps even in 90 per cent., of those in which there is no loss of tissue. In infected early cases the mechanical exposure and cleansing may be followed by a treatment directed to the removal of the remaining infection. Physiological and antiseptic methods have each their advocates. The aim of both is to permit of the earliest prudent secondary closure of the wound. In infected late cases a thorough mechanical exposure and cleansing of the wound and the parts around will allow of secondary closure forthwith if certain antiseptic pastes are used. Experience shows that similar results have followed upon this mechanical treatment of the wound without the introduction of antiseptics. A further trial in this class of cases may show that the natural defences of the tissues are ample to deal with the infections then remaining. It is the natural defensive powers of the body fluids and tissues, of serum and leuko-

cytes, that are the chief agents in finally subduing the bacterial infection in a wound. Sufficient reliance does not appear to be placed upon the stupendous power the body tissues possess for controlling infection. Finally, full emphasis must be laid on the paramount necessity for the complete immobility of wounded parts at all times and on all occasions. So will one of the most powerful agencies making for reinfection and auto-inoculation be kept in check.

Urinary Extravasation. — WOLFER (*Surg., Gynec. and Obst.*, 1918, xxvi, 296) after a careful study of some 12 cases under his own care and 31 cases obtained from the records of the Cook County Hospital of Chicago, emphasizes the following points: Extravasation of clean urine may present few signs early and not produce marked reaction for a long period of time, up to two or four weeks, and then rapidly destroy life by sepsis. Urine in the presence of a stenosis of the urinary outlet is usually septic. Many cases of urinary extravasation are caused by a rupture of the urethra due to an inflammatory process, which can be detected before perforation. Urinary extravasation must be treated according to the condition of the urine. In clean urine cases, closure of the opening with drainage in cases of necrosis is the method of treatment. In septic cases, suprapubic cystostomy, with wide incisions in all infiltrated and edematous areas, rest to the urethra, and subsequent careful dilatation of the strictures, is the only safe method of procedure.

THERAPEUTICS

UNDER THE CHARGE OF

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The Alkali Reserve in the Blood of Pellagrins.—A study of a series of 36 pellagrins, in various stages of the disease, leads JOBLING and MAXWELL (*Jour. Am. Med. Assn.*, 1917, lxix, 2026) to conclude that the alkali reserve of the blood in pellagra does not vary from the normal in either the acute or the chronic cases; therefore there is no acidosis or alkalosis in pellagra. The viscosity of the blood shows a slight decrease from normal.

Stimulation of the Respiration by Sodium Cyanide and its Clinical Application.—In a large series of animal experiments LOEVENHART and others (*Arch. Int. Med.*, 1918, xxi, 109) found that the intravenous injection of sodium cyanide caused a profound but fleeting stimulation of the respiratory center; that the continuous intravenous infusion produced a continued stimulation of the center; that the factor of safety was large, the effective dose being only about one-twentieth of the toxic.

The very marked improvement in respiration and the absence of untoward effects in animals suggested to the authors that the use of cyanides against threatened respiratory failure in man should be revived. The disrepute into which the cyanides have fallen is due, they believe, to their fleeting action, the uncertainty of absorption when administered by mouth, the instability of the preparations used and the popular but erroneous idea that the cyanides are very poisonous. The first and second of these objections were overcome by the continuous intravenous injection of the drug; the third, by using chemically pure sodium cyanide; and the last by observing the effect on the respiration, the slightest excess causing a depression which disappeared as soon as the injection was stopped. The writer and his co-workers treated 10 patients, whose death from respiratory failure seemed imminent, with the intravenous injection of fiftieth-normal sodium cyanide solution. In some patients the treatment was repeated, so that the present report comprises fifteen treatments. In every case a marked stimulation of respiration was obtained, beginning about twenty seconds after starting the injection. The degree of stimulation could be accurately controlled by the rate of injection. The duration of the stimulation following a single injection rarely exceeded thirty seconds and depended on the size of the dose and on the rate of injection. The dosage required to produce a therapeutic effect in man varied in different cases and according to the condition of the patient. When large respiratory movements are desired, as in resuscitation from drowning, a single injection of 5 c.c. may be employed; when it is desired to produce a milder but continuous stimulation of the respiration the fiftieth-normal sodium cyanide solution should be injected continuously at a rate varying from 1 c.c. in thirty seconds to 1 c.c. in fifteen seconds. By watching the injection there is no difficulty in deciding the proper rate for a given case. The injection should be slowed or stopped temporarily when any of the following symptoms appear: marked pallor, nausea, marked increase in pulse rate (30 per cent), depression of the respiration and any other untoward symptoms. In the opinion of the authors the intravenous injection of sodium cyanide should prove useful in the following conditions: depression of respiration resulting from increased intracranial pressure, however produced, until the condition can be relieved by decompression; resuscitation from drowning; embarrassment of the respiration under any form of anesthesia, and other forms of respiratory depression, when it may be given in conjunction with artificial respiration.

The Action of Tyramin on the Circulation of Man. — HEWLETT (*Arch. Int. Med.*, 1918, xxi, 411) summarizes the changes observed in 28 individuals after the subcutaneous injection of from 40 to 80 mg. of tyramin as follows: An increase in the systolic blood-pressure, the pulse-pressure and the volume pulse in the arm; a slowing of the heart rate, apparently as the result of vagus stimulation by the heightened blood-pressure and an increase in the size of the T-wave in the electrocardiogram, with the occasional occurrence of premature contractions. The maximum effect on systolic blood-pressure was usually attained within ten minutes of the injection, the return to normal occurring within twenty to thirty minutes. The rise in diastolic pressure was slight compared with that of the systolic, so that the pulse-pressure was

markedly increased. The vascular sounds heard during the auscultatory determination of blood-pressure were much louder at the height of the tyramin action. In animals tyramin has been demonstrated to possess a vasoconstrictor action, but Hewlett's observations point to an increased cardiac output rather than to a vascular effect, comparable, for instance, to that produced by pituitary extract. Hewlett believes the increase in pulse-pressure to be due mainly to the increased output of blood with each ventricular systole and not to a constriction of the bloodvessels, as in that case one would expect to find a far greater rise in the diastolic pressure than that actually observed. Moreover, the increase in arm pulse volume is not typical of vascular constriction, and is more readily explained on the assumption of an increased cardiac output. The total output of the heart per unit of time (considered as the produce of heart rate times pulse-pressure) was materially increased (50 to 100 per cent.) by tyramin. The subcutaneous injection of epinephrin for purposes of comparison was found to produce an apparent increase in cardiac output, an increase in pulse-pressure and some increase in pulse rate. As there is a close connection between ventricular fibrillation and very numerous ventricular premature contractions, and it seems possible that under proper conditions tyramin might cause a dangerous or even fatal ventricular fibrillation in man, Hewlett urges caution in the use of this drug if premature contractions are present or if there is any reason to suspect a condition of increased irritability in the heart muscle, such as seems to occur during chloroform anesthesia.

Pharmacodynamic Examination of the Vegetative Nervous System in Typhoid Fever.—This paper by MATSUO and MURAKAMI (*Arch. Int. Med.*, 1918, xxi, 399) is the result of a pharmacodynamic investigation into the condition of the vegetative nervous system in 46 cases of typhoid fever and paratyphoid B. Atropin, epinephrin and pilocarpin were injected subcutaneously in turn at intervals of from one to two days. The doses of atropin (0.001 gm.) and epinephrin (0.001 gm.) were the same as those used by Eppinger and Hess. No glucose was given, as in the original method of Eppinger and Hess, but glycosuria was qualitatively tested for. The observations were all made between the first and third weeks of the disease. The reactions observed were considered as positive under the following conditions: Atropin, 0.001 gm. When the pulse rate was increased by more than twenty beats per minute. An increase of less than twenty beats when accompanied by increased thirst or palpitation was considered positive. Epinephrin, 0.001 gm. An increase in pulse rate of more than twenty beats per minute, a rise in blood-pressure of over 20 mm. Hg., marked tremor, palpitation and glycosuria (no previous administration of glucose). An increase in the heart rate alone, unless marked, was considered negative, while glycosuria unaccompanied by other symptoms was classed as positive. Pilocarpin, 0.007 gm. Sweating and salivation alone, unless very pronounced, were not considered as positive; when accompanied by gastrointestinal symptoms the reaction was classed as positive. A summary of the findings of Matsuo and Murakami shows that of the 38 cases of typhoid fever, 14 cases corresponded to vagotonia, 11 cases corresponded to sympathicotonia, 3 cases were sensitive to all three drugs, 7 cases

were sensitive to pilocarpin and epinephrin and 3 cases were sensitive only to pilocarpin. The 5 fatal cases in this series all showed sympathicotonia, and the authors suggest that this fact may serve as a basis for establishing prognosis in typhoid fever. They consider the prognosis bad in cases of bradycardia insensitive to atropin and pilocarpin and sensitive to epinephrin. These authors found youth more sensitive than age to atropin, but no relation between age and sensitivity to pilocarpin or epinephrin.

OBSTETRICS

UNDER THE CHARGE OF

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Prophylaxis of Infection in Nurseries.—BARBIER (*Arch. de méd. des enfants*) describes the precautions taken in the Hérold Hospital, in Paris, to prevent contagion among infants. The nurses wear a veil like those worn in the operating room, and only well-trained and experienced nurses are placed on duty in these wards. Under the heads of the infants are put sterile folded cloths which greatly lessen the infections developing upon the head. One nurse has charge of the food for all of the infants, written directions being given in each case. She collects the directions and prepares the food in a room apart from the ward. The bottles are kept in wire baskets, each of which is marked with the number of the bed, and the bottles are prepared at 11 A.M. for the twenty-four hours. Infants unable to take cows' milk have done well on ass's milk when breast feeding could not be obtained. From 1909 to 1913 the mortality among 1238 infants was 35 per cent., and 29.5 per cent. of the 442 deaths were from typical tuberculosis confirmed by autopsy. There were 311 marasmic infants, among whom there were 141 deaths, and of these 62 per cent. were from septicemia, only 15.1 per cent. actually dying from marasmus. Of the infants having septicemia 70 per cent. were under six months, and in many of these hospital contagion was responsible. It is essential that each child have a separate crib and that infants already infected should be kept entirely away from others and their nurses also. As the infants grew better it was desirable to take them away from the hospital at the earliest possible moment. There were 46 cases of typhoid, none of which terminated fatally, and this is ascribed in large part to the fact that they were given no milk.

Labor Obstructed by a Contraction Ring.—WHITE (*British Medical Journal*) reported, in 1912, 3 cases in which labor was obstructed by a contraction ring. His attention was called to this condition by the examination of a uterus removed during labor by hysterectomy. This specimen showed that the contraction formed from a depression in the child's body and that the part below the ring was

not pathologically thin. Thus the ring had no connection with the ring of Bandel, commonly called a retraction ring. The case now reported is that of a primipara in labor with whom a doctor had attempted to hasten delivery by manual dilatation of the cervix and the use of the high forceps and had failed. She had been in labor forty-eight hours. On admission, the head was in the cavity of the pelvis, the child was dead and in left occipitoposterior position. It was decided to wait for uterine contractions and perform craniotomy. When the fundus occasionally contracted, the head was perforated and with great difficulty extracted from the vulva with the cranioclast but the shoulders could not be delivered, even after cleidotomy and the fundus of the uterus became tetanic. As the patient passed into shock, a 7-pound weight was tied to the cranioclast and the patient was stimulated by transfusion and external heat for between one and two hours. Delivery was then easily effected by bringing the arms down over the head and making light traction. The fundus was flaccid and the placenta temporarily retained; this was removed manually, and an intra-uterine douch was given. The mother recovered, but there was considerable sloughing of the vagina, resulting in the formation of a fistula between the vagina and urethra and ureter. His fifth case was a multipara admitted in labor with a dead child and an offensive discharge from the uterus. There was a very tight contraction ring around the thigh of the child which did not yield to pressure. The mother being infected, the entire pregnant uterus was excised. She made an uneventful recovery.

Hydatidiform Mole and Chorio-epithelioma.—CATURANI (*Am. Jour. Obst.*, April, 1917) reviews the literature of this subject and reproduces illustrations of these two conditions. He believes that our inability to determine the future course of a hydatid mole depends upon the fact that it is very difficult to secure evidence of the actual invasion of the uterus. Could we observe that, we could form a much better idea as to the outcome of the case. When a mole is present in the uterus, the wall of the womb is softened and friable, and the tissues cannot be completely removed by a curette; probably the most reliable and efficient method consists in vaginal hysterotomy, and when this operation is done, one cannot only secure the remnants of the mole, but also a small section of uterine tissue to study the question of the invasion of the wall of the womb. When an hydatid mole attacks the tissues of the vagina this could not be considered a benign process. It is different from the deportation of villi in normal pregnancy. In hydatid mole the tissues grow abnormally and rapidly develop a tumor. Considerable time may elapse between the first appearance of metastasis in the vagina and its development to a serious nature, but if such metastasis has followed an hydatid mole, there is no question regarding its malignancy. If in a suspicious case the core of the villus is present, this does not exclude the possibility of malignant change, especially if the cells of Langhans are present in large quantity. These cells are almost pathognomonic of malignancy. Should a chorionic tumor be recognized, it should be considered as malignant without hesitation. In examining the tissues of a mole, if the essentials of the primitive chorion are present and growth is taking place, the

tumor is suspicious. To positively estimate its malignancy one must study the mole in relation with the surrounding maternal structures. Where the tissues show a tendency to penetrate the uterine wall, it must be considered a chorio-epithelioma. Marchand's classification of two types, syncytioma and chorio-epithelioma, is supported by statistics from clinical observation, and agrees with the anatomical constitution of the chorionic tumors. Seven cases have come under the observation of the writer and 6 of these are reported in brief: The first occurred in a woman, aged twenty-six years, following a normal confinement at term, and vaginal tumor developing twenty-eight days after confinement. In this tumor syncytial and Langhans's elements were both abundantly present. This patient died eight months after confinement. The second case followed an hydatid mole and in this case the syncytium predominated. This patient had been ill for many months and had been curetted three times before coming under observation. The tumor had almost entirely destroyed the posterior wall of the uterus which was about to rupture. Marked saprophytic infection was present. The uterus was removed, and eight years after the operation the patient is living and well. The third patient, aged forty-three years, had hemorrhage for fifteen months and had been curetted several times. On examining the uterus after its removal a wide tumor was implanted in the posterior wall toward the fundus. This was composed of syncytial elements. The patient died five months afterward with recurrence in the pelvis. The fourth case followed an hydatid mole at the fourth month with very rapid development. When seen, the patient was in such a condition that nothing could be done. The uterus was secured by autopsy and was studded with typical syncytial growths. The fifth case was a multipara who had severe hemorrhage for which she was curetted. She was thought to have had an incomplete abortion. Hemorrhage returned and curetting was repeated, and scrapings examined, showing transitional chorio-epithelioma. The uterus was removed for repeated hemorrhage. On examining the uterus, Langhans's cells and syncytial elements were in a state of necrosis. There was no trace of villi. The ultimate fate of this patient is not stated. The sixth case followed a normal confinement and was one of chorio-epithelioma. The uterus was curetted and a small vaginovulvar tumor was removed. The patient refused radical operation, and died six months after the confinement.

Shall the Curette Be Used in Cases of Infection?—POLAK (*Am. Jour. Obst.*, March, 1917) states that in treating cases of infection following abortion one must consider the period of gestation, the condition of the cervix, the amount of hemorrhage, and the presence or absence of sepsis. In clean cases after securing free dilatation of the cervix, complete evacuation of the uterus by the curette, forceps, and finger, with a strict, septic, surgical technic and the firm retraction of the uterus, leaves the woman in the best possible condition. If, however, she has had gonorrheal endocervicitis at the time of abortion she is practically infected. The majority of abortions, however, as seen in practice are not clean, because they have been examined or tamponed without surgical cleanliness of the vulva. So frequently does infection

follow manipulation under these circumstances that the custom has recently obtained of letting the uterus entirely alone in all suspected cases. The results were that patients did much better than formerly. In following up these cases it has been found that these patients had menorrhagia, sometimes very severely; for several periods after their discharge from the hospital. Recently cases have been divided into those in which abortion was begun and completed in the hospital under the most careful asepsis, and those which began outside of hospital and had been examined or packed one or more times without proper preparation of the external parts. These later cases are considered infected. Unless hemorrhage is severe these patients are treated in the Fowler position, with an ice-bag placed over the uterus. If there is considerable bleeding a sterile vaginal gauze tampon is firmly packed against the cervix. After this method of treatment the patients had prolonged menstruation and increased quantity of blood lost. In view of these facts, when a case is admitted bleeding, a very thorough antiseptic preparation of the external parts and vagina is made, the interior of the uterus is explored, and a culture made. If this is negative the uterine content is carefully evacuated after giving, by hypodermic injection, an ampoule of pituitrin. The emptying of the uterus is done by the curette or placental forceps when pregnancy is eight weeks or under, and with the placental forceps and fingers when it is past that time. Following the emptying of the uterine contents the interior of the uterus is iodized by packing with gauze soaked with tincture of iodin, and this pack is allowed to remain for twenty minutes. The routine culture of the interior of the uterus has shown that more than 61 per cent. have a pure culture of either staphylococcus or streptococcus when such culture has been made from forty-eight hours to four days after the supposed abortion. This explains why incomplete abortion, formerly subjected to routine curetting, has subsequently developed exudate in the perimetrium. When culture showed the presence of bacteria in the uterus the expectant plan of treatment was followed until a culture from the interior of the uterus showed no organism to be present, and then the cavity of the womb was curetted and carefully iodized. This was done not only to lessen blood loss at subsequent periods but to avoid leaving adherent tissue that might favor the development of chorio-epithelioma.

Hematocolpos in a Woman Aged Seventy-four.—GELLHORN, (*Surg., Gynec. and Obst.*, January, 1917) reports the case of a woman, aged seventy-four years, who had menstruated normally until thirty-five years previously. Then severe pain and obstruction to the discharge of urine lead to an examination. A large, fluctuating tumor was found filling the pelvis, extending upward almost to the umbilicus. The atresia of the senile period had entirely closed the vagina. Section was performed under spinal anesthesia and an enormous distention of the uterus and tubes with blood was found. The entire uterus was then removed and the tumor, which was connected with the vagina by loose connective tissue only, was removed unopened. The patient died from embolism on the fifteenth day. The cause of the bleeding was adeno-sarcoma of the body of the uterus.

GYNECOLOGY

UNDER THE CHARGE OF
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Radium in Uterine Cancer.—The experiences with radium in the treatment of uterine cancer at the Memorial Hospital in New York have been presented by BAILEY (*Surg., Gynec. and Obst.*, 1918, xxvi, 625), and he states that the recurrent cases showed the lowest percentage of improvement. The recurrence is usually behind the vaginal vault and the vagina itself is usually foreshortened and contracted. The primary cases are more amenable to the application of radium and the results are slightly better than when previous treatment had been instituted. Twenty-one per cent. of this class showed marked improvement with the possibility of remaining free from cancer. When a period of two years passes a fairly good estimate may be made as to ultimate results, and although not over 15 per cent. of the cases lived to that period, in those that did live the probabilities of complete retrogression are great. On the other hand, over 80 per cent. lived through the first six months, and it is very difficult to sift the good from the bad, for nearly all showed local improvement. Bailey is convinced that the inoperable cases do better without the preliminary Percy treatment, and he also believes that the initial dose of radium should be high and that it should seldom be repeated for the same area. Cross-firing should be made use of from within and from the surface of the body.

Radium in Uterine Hemorrhage.—The term uterine hemorrhage as employed by MILLER (*Surg., Gynec. and Obst.*, 1918, xxvi, 495) is limited to bleeding due to metropathies, disturbed ovarian function, chronic endometritis, metritis and fibroids of the uterus. Bleeding associated with syphilis, chronic liver and heart disease, lung and kidney affections, as well as the ordinary complications of pregnancy, is naturally eliminated and mentioned to emphasize the point that uterine bleeding is only a symptom and demands careful differentiation and accurate diagnosis in its management. Every gynecologist is impressed with the large number of cases of persistent bleeding that eventually require hysterectomy. If he is conscientious he can only regret keenly the necessity of performing a serious mutilating operation, especially when the pathologist reports little if any pathological change in the uterus. Radium has proved to be the long-sought specific in these cases, because of the simplicity of application, the short amount of time required to effect a cure and the uniformly satisfactory results obtained. The most plausible explanation of the action of radium in these cases is that it produces extensive structural changes in the endometrium. The author has had considerable experience along these lines and for the purpose of study has divided his cases into groups. The first group includes the cases commonly denoted as myopathia hemorrhagica (hemorrhage of the menopause). These cases, as a rule, present little

if any defined anatomical cause to account for the bleeding and comprise some of the most serious instances of acute hemorrhage. It occurs most commonly in women approaching the menopause, though it may be found in comparatively young women. The uterus may be normal in size or slightly enlarged, and often presents a normal endometrium. The bleeding is supposed to be due to a disproportion of connective tissue over muscular tissue in the myometrium or to some aberration of ovarian secretion or other ductless glands. In these cases the bleeding was controlled primarily in 100 per cent., with 90 per cent. of permanent results. The average time from the treatment until amenorrhea occurred was four weeks. The second group included patients presenting a history of menorrhagia or metrorrhagia, lasting for months or years, practically all of whom had a uniformly enlarged, hard or occasionally flabby, uterus. Many gave a history of puerperal complications. In some, the origin of the trouble appeared to be extensive lacerations of the cervix, involving the parametrium. These cases are ordinarily classified as chronic metritis, polypoid endometritis, hyperplasia, fibrosis, etc. Amenorrhea was produced in every case within one month after treatment, and all but two of the eighteen cases have recently been communicated with and none report a return of the bleeding. Many presented an enlarged uterus before the treatment, but every one examined three months or longer after the treatment showed a uterus approximately normal in size. The menopausal symptoms seemed to be more pronounced in this group than in any of the other series. The group of myomata comprises 26 cases, and in 22 cases the bleeding ceased within five weeks and has never returned. In 5 cases it was controlled for a few months, but was never so severe after its reappearance, while in 2 of these the menses became regular after eight months. In only 2 cases has the radium failed, and these would very probably have been relieved by another radiation. Control of bleeding is not the only desideratum in treating fibroid tumors; the growth of the tumor must be stopped and, if possible, the tumor be made to disappear. In 16 cases examined from three months to two and a half years after treatment there has been a reduction in the size of the tumor varying from complete disappearance in 3 cases to about one-half the original size in practically 50 per cent. of the number. Some further points in regard to the fibroid group are worthy of comment, namely, most of the growths selected for radium treatment were small, the only large tumors being those presenting contra-indications to operation. This feature is emphasized because Miller does not wish to imply that radium is to supplant surgery in the treatment of fibroids, but it is a most valuable adjunct to surgery. Two cases in this series illustrate conclusively that radium is more effective than the roentgen rays. Both had been given twenty exposures by an experienced roentgenologist, who employed the Gauss technic, with only temporary results. Only one intra-uterine application of radium sufficed to stop the bleeding permanently. In a fourth group the author records 2 cases of serious uterine bleeding in young girls who had been treated by rest, tonics, astringents, ovarian extract and curettage. The uterine scrapings apparently showed hyperplastic glandular endometritis. The application of small doses of radium produced results that were all that could be desired, even though the risk of permanent amenorrhea was greater than should be taken in the ordi-

nary case of this type. Both of these cases now menstruate regularly after a period of amenorrhea which lasted three months. While the results obtained by various authorities with the use of radium are practically the same, the dosage employed has been by no means standardized. It has been practically established that a 1000-milligram-hour exposure is almost certain to produce permanent cessation of the menses, but in the treatment of fibroids the size of the growth and the degree of hemorrhage should govern the amount used and the duration of the exposures. If the only annoyance a woman experiences who suffers from a fibroid is bleeding, is there sufficient justification for performing hysterectomy? To this question the author answers in the negative. If the growth is sufficiently large to produce pressure symptoms, operation is preferable because of the time consumed in reducing it by radium. If evidence of infection or degeneration exists or the appendages are diseased, operation is the best procedure. If the woman is young she should be advised to submit to operation with the idea of performing myomectomy and preserving the uterus. For small and medium-sized growths and those presenting contra-indications to operation, radium is the ideal remedial agent. Submucous growths should be treated surgically unless contra-indications to operation are present, owing to the tendency of this type to become infected or develop other degenerative changes.

End-results of Cystocele Operations.—The condition of the interior of the urinary bladder in patients who have had some sort of cystocele operation has been studied by BROUN and RAWLS (*Surg., Gynec. and Obst.*, 1918, xxvi, 502). In securing the end-results it was considered necessary that at least one year should have elapsed since operation before the examination of the bladder was performed. In all they examined about 50 patients cystoscopically, and with 1 exception none of the patients examined stated that any urinary symptoms they might have had were aggravated by the operation; to the contrary, the very large majority stated that they had been in part or entirely relieved of such symptoms. This fact is very striking, since only 9 of the 49 patients examined showed a normal bladder base. The character of the cystocele operations done upon these patients varied greatly, but in the larger number the operative procedure consisted in freeing the bladder from the vaginal mucosa and uterus, coapting the prevesical fascia under the bladder and approximating the vaginal mucosa after the excess had been removed. In a series of 8 patients the base of the bladder was found to be thrown into horizontal folds of varying degrees of prominence, but the kind of operation done did not seem to bear in a marked degree upon the character and extent of the permanent folds found to be present. As an end-result in all of the 8 patients under consideration in this group it was found that in 6 there were no urinary symptoms, while in the remaining 2 the urinary symptoms prior to the operation were improved. In another group of patients the folds of the base of the bladders were found to be from side to side (transverse), opposite to the direction of the folds of the bladder bases of those just reviewed. Here, again, the character and degree of the convolutions, as in the previous cases, did not bear any definite relation to the kind of operations done and, furthermore, no vesical irritation that was present

could be charged up to the operation. The final group of cases brought together are those on whom the uterus was interposed between the bladder and the vaginal layers, including 10 cases. As would be expected the bladder base was thrown into a large horizontal fold, with deep sulci on one or both sides and also frequently above the fold. Trigonitis, with the frequent presence of dilated capillaries throughout the entire bladder mucosa, was the rule. The vesical symptoms of the patients of this group were as with the patients of the previous groups, remarkably negative. Seven patients were free from any vesical irritation or frequent urination; with one the loss of control before the operation was not relieved. This detailed review of the study of the end-results on these patients, from the view-point of the anatomical condition in which the base of the bladder is left, is surely not of a flattering character. That the abnormal character of the conditions found were permanent cannot be questioned, since they did not disappear under full distention of the bladder as would have occurred if they were merely due to incomplete filling of the bladder at the time of the examination. The query naturally presents itself that although apparently there is no disturbance as a result of this departure from the normal plane-like floor, does not such a state render more possible some future disturbance of a systemic character? The truth of such a possibility cannot, from the nature of the condition, be determined except by painstaking investigation of each individual patient over a long period of years, and this is hardly possible on account of the nomadic character of the average hospital patient.

OPHTHALMOLOGY

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Traumatic Variations in the Tension of the Eyeball.—MAGITOT (*Ann. d'Oculist.*, January, 1918, 1) publishes a study of the tension of the globe as affected by traumatism, which may show itself either in hyper- or hypotension. He regards this as depending upon two principal causes: active and passive. The former depends upon mechanical interference of the venous circulation in the orbit, hence extra-ocular. This gives rise to hypertension and persists as long as the disturbance in the circulation continues. The latter is due to a traumatism acting upon the intra-ocular vasomotor nervous mechanism. Traumatisms of too slight intensity to determine within the globe grave lesions of the membranes may, however, occasion remarkable alterations in the tension of the organ revealing itself as a disequilibration which becomes sensible as greater or less to the tonometer. Usually the hyper- or hypo-

tension tends to recede and the globe to take up the tension of the healthy eye; but in some cases a veritable instability of tonus occurs which may show itself brusquely as considerable variations in the tonometric readings; finally, in other cases, the disturbance of equilibrium persists as hypo- or hypertension. These phenomena are analogous to the vascular instability which occurs in shock. They depend upon vasodilatation or vasoconstriction due to reflex action of the intra-ocular sympathetic center.

Tuberculin in Eye Diseases.—VERHEYDEN (*British Jour. Ophthal.*, April, 1918, 223) makes a plea for the more frequent use of tuberculin in strumous eye affections involving the conjunctiva, cornea, iris, ciliary body, sclera, choroid and tuberculous paralysis of the third nerve. A number of cases are detailed in which this treatment was highly satisfactory. Concomitant treatment consisting of 4 per cent. solution of dionin and subconjunctival injections of saline solution are useful adjuvants. He concludes that many eyes will be saved by tuberculin which would formerly have been lost or greatly damaged. Carefully tested and manipulated, risks of accidents from tuberculin are negligible; the results will be most gratifying in confirming a doubtful diagnosis and in ameliorating or altogether curing these serious and rebellious diseases.

Iritis and Cyclitis in Dysentery.—MAXWELL and KIEP (*British Jour. Ophthal.*, February, 1918, 71) observed 6 cases all from the Mediterranean area, the subjects of infection with Bacillus dysenteriæ (Shiga), who developed iritis or cyclitis. They conclude that patients suffering from an infection by this bacillus may occasionally develop anterior uveitis as a result of this infection, as pointed out by Morax. The ocular infection may or may not be accompanied by articular manifestations. These affections would appear to occur most frequently about a month after the first signs of involvement of the bowel, but may occur as early as the twelfth day. The articulo-ocular syndrome corresponds exactly to that occurring in another infection of a mucous tract, viz., gonorrhea, as pointed out by Garrod.

Close versus Distant Illumination for Operations.—MADDOX (*British Jour. Ophthal.*, February, 1918, 84) has attached to conjunctival forceps for operations on after-cataract as well as for emergency night operations a tiny screened electric lamp to one limb of the forceps half an inch from the gripping end. This attachment can be made with adhesive strapping or, better still, by a very light metal clip or steel wire, into the curl of which an ordinary bulb from a child's flash lamp is so screwed as to illuminate the iris brilliantly, when the forces are gripping the limbal conjunctiva. The connecting cord must be of a feather-weight character. The grip of the forceps ensures a perfectly steady light and maintains its distance from the cornea constant. It is for needling operations that the method is ideal, and it also greatly facilitates the removal of foreign bodies from the cornea. While distant lights have some advantages of their own, especially in large hospitals, some form of close illumination has certain advantages: these are greater economy, greater portability and greater kindliness to the patient's eye. A close light is diffused widely over his retina, with no

possibility of the image of the filament being thrown thereon. It also increases the surgeon's visual acuity. The smallness of the patch of light on the patient's eye is less disturbing than a widespread reflection from the whole face and pillow.

Disinfection of Artificial Eyes. — COULOMB (*Ann. d'Oculist.*, April, 1918, 202) observes that while the method of choice is boiling it is extremely slow. The eye must not only remain in boiling water long enough, but to avoid cracking it is placed in cold water, the temperature of which is cautiously raised. After sterilization the water must be allowed to cool slowly and gradually to the room temperature. Placing a cold artificial eye in boiling water will invariably crack it. The author has experimented with new eyes, both double and single shells, and with pieces of old ones; the pieces were rubbed upon a carpet or on the ground. Immersion in various antiseptic solutions (bichloride of mercury, formol, etc.), failed to sterilize, as proved by the development of numerous colonies of different microbes upon culture media. In view of these negative results further experiments were made which led to the discovery that Gram's fluid (iodin 1, iodide of potash 2, water 300) furnishes a satisfactory solution; after immersion from five to ten minutes no colony developed in any of the tubes; in fact, when the time of immersion was reduced to as short an interval as seven seconds no colony was found to have developed five days later. It was also found that if the solution be diluted one-half it was still sufficiently strong for practical purposes. Tincture of iodin alone has the disadvantage that it stains the fingers and is much more difficult to wash entirely from the artificial eye—an inconvenience which does not belong to Gram's fluid, which is readily removed by rinsing in cyanide of mercury, 1 to 5000, or simply sterilized water. The experiments further showed that a new eye is more easily disinfected than an old one and that the double shells are more quickly sterilized than the single pieces. The above method is simple and entirely efficacious.

Simple Method of Recognizing Feigned Diplopia.—TERRIEN (*Arch. d'Ophtal.*, January-February, 1918, 45) recommends for the detection of simulated diplopia, placing successively a light blue glass immediately followed by an opaque one before the same eye, the subject under examination being in an ill-lighted room, and fixing a small flame. If he continues to complain of diplopia after the substitution of the opaque for the colored glass he is evidently simulating. Diplopia, as is well known, being frequently purely subjective of numerous simulated or exaggerated ocular affections, is one of the most difficult to recognize, particularly if it has actually existed for a time and the patient desires to prolong his period of disability. In slight cases the absence of limitation of movements of the globe and the integrity of the field of fixation render it impossible to exclude all possibility of diplopia and to assert positively simulation or exaggeration. Prisms, the diploscope or repeated examination with colored glasses may, from the discordances in the patient's assertions, determine the degree of sincerity; but frequently the data so obtained, even when there is no intention of simulation or exaggeration, in individuals not trained to observe, may leave the examiner in doubt. The advantages of a simple method like the above are obvious.

OTOLOGY

UNDER THE CHARGE OF

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Primary Mastoiditis, with Report of a Case.—SONNENSCHEIN states (*Illinois Med. Jour.*, September, 1917) that the existence of a primary infection of the mastoid cavity has always been questioned, and the reported cases of this kind are rare in the literature of the subject, the assumption usually being that the mastoiditis is really secondary to a middle-ear inflammation, of fugitive character or minor evidence. In the case cited by the author the patient, a man, aged thirty-four years, with a negative history as to tuberculosis or syphilis, had complained of a pain in the left mastoid, especially at night, during three weeks preceding examinations. The left membrana tympani was practically normal on inspection, the left mastoid process somewhat tender; the hearing for unaccentuated whisper in the left ear was six meters, in the right ear seven meters. All tuning-forks were well heard in the left ear, and Weber was not lateralized. The pharyngeal mucosa was injected and the lymphoid tissue hypertrophied, and there was some tenderness and swelling of the left cervical lymph glands, but absolutely no involvement of the middle ear. For the relief of pain a carbolized glycerin pack was inserted in the canal, alcohol dressings were ordered for external use and internal medication included magnesium salicylate. For a period of two and a half weeks the patient was seen only occasionally, the pain varying in severity and at times almost disappearing. By the end of this time there was some desquamation of the left membrana tympani, but no other changes except a lessening of the hearing for the tuning-forks in the left ear. Ten days later the pains were very severe and a wide paracentesis was done without evidence of pus or other middle-ear secretion, but a few vesicles had appeared in the external canal. The Weber was now lateralized in the left ear. Two days later the patient was admitted to the hospital. The blood count showed 18,000 leukocytes; two days later there were 18,400 and two days later still 14,200. On admission to the hospital the temperature had a range of from subnormal to 101° F., and during the following week from subnormal to 102° F. Five days after admission there was swelling of the bony canal and the next day swelling over the left mastoid accompanied by a marked drop in the hearing. Under these conditions a second paracentesis was done, but again without the liberation of pus. The leukocyte count on the day of the second paracentesis was 17,600, and the day following, the swelling not having changed, a mastoid operation was done, exposing a small fistula near the posterior meatal wall. A large quantity of pus was found and much destruction of the mastoid process, together with a wide exposure of the dura and lateral sinus, both of which tissues appeared normal. A spinal puncture, made directly after the operation, gave negative results. Within a few days

the leukocyte count decreased, and ten days after the operation reached 10,200, the differential showing 56 per cent. neutrophiles, 27 small mononuclears, 16 per cent. large mononuclears and 1 per cent. transitionals. From this point the temperature gradually subsided and the patient made an uneventful recovery, the wound closing in about seven weeks, and the hearing steadily improved during the succeeding two months until it became normal for the whispered voice. At no time before or after the operation was there any discharge from the ear by way of the external canal. The justification of the author's claim that the classification of this case is that of a primary mastoiditis is based upon the fact that, notwithstanding the evidences of pain in the left mastoid for a period of three weeks, there were no changes on objective examination of the membrana tympani and the hearing remained good; further, that two free incisions of the drum-head, made at different times, liberated no pus from the middle ear, and that there was no impairment of hearing until a time coincident with the operation and swelling over the left mastoid, at which time the hearing suddenly lessened.

The Value of the Galvanic Method of Testing the Functions of the Inner Ear and Eighth Nerve.—MACKENZIE (*Ann. Otol., Rhinol., and Laryngol.*, September, 1917). Following a review of the caloric and rotational tests of function of the labyrinth the author emphasizes the value of the galvanic test, for which certain essentials are required: A suitable electric apparatus with clean contact points; an accurate milliampèremeter; a reversing switch under the control of a capable assistant governing the polarity, the amount of current and observing the milliampèremeter; two electrodes, one about 2 inches square and flat and the other a small ball electrode, about a quarter of an inch in diameter, both electrodes being wrapped in cotton or gauze moistened with salt solution. The primary examination should be made to determine any spontaneous nystagmus, the presence or absence of which should be noted, the patient's head being tilted slightly backward to make a better observation of the eyes by the examiner, looking straight forward, with the result of looking slightly downward in consequence of the downward inclination of the head. The square electrode is held by the patient in either hand, the examiner applying the ball electrode to the tragus, pressing the tragus inward with one hand and lifting the lid of the patient's eye with the other hand in order to better observe movement. The author's conclusions from his observation of a large number of cases is that the galvanic test is more accurate than either the caloric or rotational test. Besides being more accurate the galvanic test is the least annoying to the patient, the most sensitive and the easiest to control. It can be applied as a unilateral test in all sorts of pathological conditions, which is an advantage that cannot be conceded to the caloric, and it is applicable to cases of suspected unilateral labyrinth suppuration, with obstruction in the external canal where the caloric test may fail. That it is a unilateral quantitative test, which is a distinct advantage over the rotational test, which is at best a bilateral test. That it is the only test that we possess for testing the function of the eighth nerve in cases of neuritis or cases of secondary degeneration following destruction of the inner ear, and it is the only test whereby it is

possible to make a differential diagnosis between labyrinth destruction and eighth-nerve neuritis. That it is the only test available for determining the progress of eighth-nerve neuritis, whether favorable or unfavorable, these conclusions emphasizing not the lack of value in the caloric or rotational tests, but the fact that the galvanic test is, in all respects, the best, and has a distinctive value in differential diagnosis.

An Air Raid Case.—YEARSLEY (*Jour. Laryngol., Rhinol., and Otol.*, September, 1917) records a teacher, aged twenty-seven years, who was standing by the front door of her school, superintending the passing of her class to the basement, when a bomb was dropped some yards away in the street. The door was burst open by the explosion and she was thrown down, sustaining a scalp wound. She did not lose consciousness but found that she was markedly deaf, especially in the left ear, with loud ringing tinnitus. By the next day this symptom was much improved but the impairment of hearing remained much the same. There was much difficulty in distinguishing low tones and distant sounds. There was no vertigo. On examination the right drum-head was found to be markedly indrawn and the appearance of the superior posterior quadrant suggested a perforation, the long process of the incus standing out clearly. Movement was visible, however, over the apparent perforation, suggesting the presence of a strongly indrawn flaccid posterior segment. The handle of the malleus moved freely. There was nothing noteworthy in nose, throat, or nasopharynx. The fundamental tests gave the following reactions: Weber's test showed no reference to either side. Rinné was just positive to the C 128 fork on both sides. Bone conduction to the 35 sec. fork was right 36″, left 40″. The hearing for low tones was right 2 C 32, left 1 C 64; that for high tones was over 15,000 double vibrations on both sides. The whispered hearing was right, 7 feet; left, 25 inches. The case appeared to be one of acute depression of the tympanic membrane from sudden increase of external pressure. The appearance of the membrane varied remarkably. The right was indrawn but it was evidently thickened. The left looked as if a very flaccid posterior segment were lying in the internal tympanic wall. It was the left ear which was toward the explosion. The functional tests indicated a middle-ear condition by increased bone conduction and loss of low tones, but not a very marked or long-standing one. Rinné reaction still positive, bone conduction only very slightly increased and no implication of the labyrinth. On using the Eustachian catheter there was no perforation-sound in the left ear and the appearances noted in the tympanic membrane before inflation were less marked. The hearing for the whisper after catheterization was right, 15 feet; left, 8 feet. One month after the accident the hearing was much improved and the tinnitus was reduced to an occasional slight ringing, especially on recumbency. The hearing for the whispered voice was 15 feet for both ears and the Rinné reaction was more markedly positive on the two sides. The Eustachian catheter again failed to elicit any perforation sound. In conclusion the author remarks that it would be interesting to know the proportion of pure middle-ear cases, such as this, to labyrinthine concussion after exposure to high explosives, he having seen two similar cases in officers from the front and having heard of others.

DERMATOLOGY

UNDER THE CHARGE OF

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The Treatment of Keloid by Injections of Creosoted Oil.—LESIEUR (*Jour. de méd. de Paris*, May, 1918) employs injections of creosote in sterile olive oil, 10 c.c. of the former in 150 c.c. of the latter, in the treatment of keloid. The puncture is made in the sound skin close to the growth and the oil injected beneath, but not into the keloidal tissue. From 2 drops to 5 c.c. are injected at each treatment, care being taken not to overdistend the tissues; the injections are made every two days or even every day according to circumstances. There is at first a diminution, later complete disappearance of the rosy or violaceous tint of the keloid; itching and pain if present cease with the first injection; the skin becomes supple and the growth finally flattens out and disappears. These results are obtained in from fifteen days to two months; in some instances, however, it may be necessary to continue the treatment for six months. The author has employed this method of treatment in 100 cases and regards it as very satisfactory.

The Treatment of Dermatitis Venenata by Vegetable Toxins.—STRICKLER (*Jour. Cutaneous Dis.*, June, 1918) from an experimental study of dermatitis venenata concludes that the intramuscular administration of the toxins obtained from various poisonous plants influences the course of the disease although he does not advocate this procedure as a routine method of treatment and would employ it only in extremely severe cases. He believes the immunity obtained is a tissue immunity which is very transitory and must be frequently renewed. He thinks it possible to produce an endemic test by which the particular plant to which the individual is susceptible may be detected. He failed to find any complement-fixing bodies in the serum of those who had an attack of dermatitis venenata and who had been treated by injections of homologous vegetable toxins. He regards it as possible to desensitize individuals so that they may be immune from the affection. (Von Adelung, experimenting upon rabbits and guinea-pigs with poison oak, was unable to produce immunity.—M. B. H.)

Pyodermia of Parasitic Origin.—SEMON and BARBER (*British Jour. Dermatol.*, July-September, 1917) report their experience with pyogenic infection of the skin as a complication of scabies and pediculosis. They find that the disability produced by pyogenic infection is considerable, no less than 94.3 per cent. of the cases admitted to a military hospital for diseases of the skin under their care being of this nature. They find that the Pediculus vestimentorum, in a considerable number of cases, lays its eggs in the hair of the pubis, the perineum and sometimes of the axillæ and other hairy regions, therefore disinfection of the clothing alone is not sufficient to get rid of the parasites, but the

host himself should be disinfected. They regard it as extremely probable that the pyogenic lesions in pediculosis begin around the bite of the pediculus. The severity of the lesions, especially in scabies, is very much increased by the presence of seborrheic diathesis, the itch mite under such circumstances being a most potent agent in producing an acute seborrheic dermatitis. Pyodermia accompanying scabies or pediculosis usually recovers rapidly if the cause is recognized and appropriate treatment adopted.

Ulcerating Granuloma of the Pudenda.—PARDO (*Jour. Cutan. Dis.*, April, 1918) reports 2 cases of this malady, the first to be reported in Cuba. The first patient was a young mulatto woman, aged twenty-four years. An extensive ulceropapillomatous area, with sharply defined and elevated borders, occupied the groins, the vulva, the perineum and the anal region. The disease had begun five years before as a small sore on the right labium majus, which had slowly extended in all directions. A month's treatment with salvarsan (three injections) and potassium permanganate solution, 1 to 1000 locally, having failed to produce any improvement, intravenous injections of tartrate of antimony and potassium were resorted to, 5 c.c. of a 1 per cent. solution being given every other day. Improvement was observed after the fourth injection and continued until, at the end of five months, cicatrization was almost complete. As the patient then passed from observation the final result was unknown. Similar treatment was begun in the second case, a white man, aged twenty-five years; but as he did not return after the first injection there was no further opportunity to follow up the case. Although the first and only cases recorded thus far in Cuba, the author believes the malady is not uncommon in the island, since he has been told of the existence of similar cases by country practitioners, especially in the eastern part.

A Common Origin for Shingles and Chicken-pox.—LE FEUVRE (*British Jour. Dermatol.*, October-December, 1917) believes there is a close etiological relationship between herpes zoster and chicken-pox. He has collected about 50 cases, 7 of which were under his own observation, in which these diseases occurred so closely associated as to suggest the probability that they had a common origin. In the author's 7 cases an attack of zoster was followed in from twelve to twenty days by chicken-pox in some other member of the family, in all cases a child. Of the whole number of cases collected 41 showed this sequence, while in a much smaller number (5 cases) zoster followed the chicken-pox; in 4 cases the two diseases were concurrent. The author believes shingles to be an infectious disease, which, under certain unknown conditions, may serve as the starting-point for an epidemic of chicken-pox, and should therefore be placed in the list of notifiable diseases.

Treatment of Psoriasis by Intramuscular Injections of Pure Sulphur in Solution.—BORG (*La Presse méd.*, June 7, 1917) has obtained encouraging results in the treatment of psoriasis from injections of sulphur in oily solution. For these injections he has employed the following formulæ: Sulphur precip. pur., 20 cgm.; ol. sesami (or

paraffin liquid), 100 c.c.; or sulphur. precip. pur., 20 cgm.; ol. eucalyptol., 20 c.c.; ol. sesami, 80 c.c. Of these solutions he gave 5 c.c. at a dose, the equivalent of 1 cgm., making the injections deeply into the gluteal muscles. One case was cured by one injection, one by four injections and a third improved after eight injections. As only 5 cases have as yet been treated, definite conclusions concerning the value of the treatment are not yet possible.

Eczema Due to Deficient Thyroid Secretion.—EDELMAN (*New York Med. Jour.*, March 9, 1918) reports the following unusually interesting case: A boy, previously apparently in good health developed, when four years old, a more or less general eczematous eruption in places dry and scaly, in others moist or weeping, accompanied by severe itching, which was worse at night. This eruption continued unabated notwithstanding much treatment, both local and dietetic, at the hands of pediatrists and dermatologists, until he was three and a half years old. When he first came under the author's observation he was fairly well nourished, but presented a cretinoid facies, had a pasty color and a general adenopathy. There was no body hair, the brows were scanty, but the hair of the scalp was coarse and abundant. The patient was placed upon thyroid extract three times a day, without any local or dietetic treatment, and improvement began at once, so that within five days "the eczema of the face and neck had almost disappeared." This improvement continued for another week when owing to rapid loss of weight, the thyroid was stopped and local and dietetic treatment instituted. When seen again the eruption was very much worse and the thyroid was again given with markedly beneficial results as before. Improvement continued, and when last seen the boy was normal in every respect. The author believes hypothyroidism was wholly responsible for the eczema, an opinion supported by the remarkably prompt improvement following the administration of thyroid extract and the equally prompt relapse following its suspension. He believes that thyroid should be given in eczema only when definitely indicated by other symptoms, and that it should be given in fairly large doses at first, to be followed later by smaller ones to prevent relapse.

PATHOLOGY AND BACTERIOLOGY

UNDER THE CHARGE OF

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Quantitative Relationship between Antigen Dose and Antibody Production.—The question of whether the amount of antigen introduced into an animal has any bearing upon the extent of the immune reaction has been repeatedly discussed in relation to specific types of antibodies.

TSEN (*Jour. Med. Res.*, 1918, xxxvii, 381) has brought forward evidence that no such quantitative relationship between the antigen dose and antibody exists. His conclusions are drawn from a series of experiments in which precipitins and agglutinins were quantitatively estimated. The precipitins were obtained by intravenous injection of different doses of sheep serum into rabbits, while the agglutinins were obtained in the human after the administration of antityphoid vaccine. He points out that individuals differ greatly in their response to the injection of foreign proteins, but the injection of large quantities is no guarantee of the production of large amounts of antibody. To a certain extent the potency of a serum in antibody rests in the manner of the giving as well as in the individual response of the animal tissues.

Chronic Tonsil Infections.—MOORE (*Jour. Lab. and Clin. Med.*, 1918, iii, 283) offers a discussion on chronic infections of tonsils based upon the work of various investigators. He describes the anatomical structure of the tonsil, and he points out that because of its position and structure the tonsil is more prone to infection than almost any other organ in the body. Because of its position it comes in contact with the various species of bacteria in the mouth cavity. More important than this, however, is the deposition of these bacteria with food and other débris in the lumina of the crypts. Chief among the bacteria causing either acute or chronic tonsillitis is the streptococcus. Davis isolated hemolytic streptococci in the majority of 133 cases of tonsillitis which he studied. The patients had been suffering from chronic arthritis, endocarditis and nephritis, and although this streptococcus produced arthritis in rabbits, there is no proof that it is the causative factor. In almost all tonsils, pathological or not, hemolytic streptococci producing arthritis in rabbits can be isolated. The author here refers to Rosenow's theory that bacteria isolated from the apparent focus of infection will produce similar lesions in animals. Tuberculosis and syphilis are of considerable interest as chronic infections. Out of the author's series of 250 pairs of tonsils, tuberculosis was present in 2.5 per cent. Primary tuberculosis of the tonsil varies from 1 to 5 per cent., and the tubercle bacillus is rarely found in tonsillar crypts. Syphilis of the tonsil may be primary, secondary or tertiary, and varies from 6 to 55 per cent., women being most commonly affected. Actinomycosis of the tonsil has been occasionally described. Davis thinks no well-authenticated case of primary actinomycosis of tonsil has been reported. Diphtheroids are not uncommon as infective agents. Occasionally the pneumococcus is isolated as well as the staphylococcus, B. diphtheria, B. influenza and B. mucosus capsulatus. The author emphasizes the importance of the tonsil as a portal of entry for numerous infectious organisms and that its removal may aid materially in controlling such diseases.

The Production of Antipneumococcus Serum.—COLE and MOORE (*Jour. Exper. Med.*, 1917, xxvi, 537). All kinds of animals, even the most susceptible, may be rendered actively immune to pneumococcus infection by bacterial inoculations. In the production of immune serum for therapeutic purposes strict attention must be paid to the immunological specificity of the bacteria used for immunization. At present the only serum of which the therapeutic value has been proved is that

effective against Type I pneumococcus infection. Active immunity to the different types also seems very specific. The serum to be used should have agglutinating power for Type I pneumococcus and should have the power of protecting mice against large amounts of virulent culture. For therapeutic purposes one should use the horse, which is sound and healthy and without old joint injuries. The intravenous method of injecting the culture is the most valuable one. Experiments have shown that for producing the primary immunity most rapidly several series of small doses of dead cultures should be given, the injections being made daily for six to seven days followed by a week in which no injections are made. To produce the highest type of immunity living organisms are required. The virulence of the particular strain of pneumococci used for inoculation purposes is important, and this virulence should be preserved by repeated animal inoculations and only fresh cultures are to be used for the immediate injection. The living organisms should be given in moderate doses daily for three days, with an interval of a week between each series of injections. By following the methods here described, horses may be made to produce rapidly a high grade of specific serum. The observations made in this work indicate the importance of employing small doses of culture frequently repeated in this form of immunization.

Anticomplementary Power of Human Serum and the Wassermann Reaction.—In 1914 Nicolas and Gate pointed out that the anticomplementary power of human serum frequently prevents hemolysis of red blood cells in the course of the Wassermann reaction. It is necessary therefore to neutralize entirely and exactly the anticomplementary action if one wishes to obtain a pure Wassermann reaction. HOLLANDE (*Jour. de Physiol. et de pathol. générale*, 1917, xvii, 684) decided to determine methodically the anticomplementary power of each serum before doing a Wassermann. The author determined the quantity of titrated complement which should be added to a constant volume of the inactivated serum in order that its antihemolytic action be neutralized. The quantity of complement which is necessary and sufficient for total hemolysis constitutes what the author calls the "constant complement," representing the exact quantity of complement which is necessary to neutralize the anticomplementary power of the serum of disease and bring about hemolysis. In thus always determining the anticomplementary power of the serum before proceeding with the Wassermann reaction the author found that 8 per cent. of the sera have a constant complement. The anticomplementary power of the serum seemed to correspond to the increase of the albuminous substances: the presence in the serum of natural hemolysins against the red blood cells of sheep tends, on the contrary, to diminish this power.

Preservation of Antisheep Hemolytic Amboceptor in Glycerol.—The hemolytic system is very widely used as an indicator in determining whether a specific type of amboceptor or antigen is present in a given material. In practice the use of the indicator has mainly fallen to the technic of the Wassermann reaction and the tests on the binding of complement in the presence of the immune bodies in the serum of suspected cases of gonorrhea, typhoid fever and a few other infections.

Inasmuch as the hemolytic system serves as a indicator it is essential that its component parts be as stable and constant as possible. The chemist has his various color reactions which serve as indicators for the detection of certain definite substances. In the case of the hemolytic system the indicator is not a single substance but a group of them. Each of which has labile quantities. It is because of the danger of deterioration and change in the components of this indicator that the greatest care is necessary before using them in any given test. Investigators have found that when amboceptor is stored in the fluid state, it is liable to undergo deterioration with varying rapidity. There is also constant danger that the serum will become infected during storage and use. To prevent infection various mild antiseptice as thymol, camphor and chloroform have been used, but again discarded by most workers because of changes occurring in the serum in their presence. CLOCK and BEARD (*Jour. Infect. Dis.*, 1917, xxi, 404) have experimented with glycerol as a preservative for the hemolytic amboceptor and find that it offers many advantages. When mixed with an equal amount of fresh amboceptor heated to 55° C. the serum was found to retain its original potency for three years. No anticomplementary properties developed during this period. The presence of the glycerol did not influence the complement-fixation reaction. The presence of the glycerol presented bacterial growth similar to its action when used in vaccine lymph.

Food Accessory Factors (Vitamins) in Bacterial Culture with Especial Reference to Hemophilic Bacilli.—It is now generally conceded that food accessory factors (vitamins) are as essential for proper development and maintenance of health as proteins, carbohydrates, fats and salts. They also play an important part in the nutrition of the lower forms of animal life, of the higher plants and of bacteria. Various investigators have carried on experiments with yeast, peat and the hemophilic bacteria. Pfeiffer in 1892 made the discovery that not only blood was necessary for the continued growth of the influenza bacillus but also that hemoglobin was the essential constituent in the blood upon which growth depended. In further investigation, DAVIS (*Jour. Infect. Dis.*, 1917, xxi, 392) found that hemoglobin alone will not support growth but that a second factor which resides in many bacteria, fresh animals and plant tissues is necessary. This second substance is being studied further to determine its peculiar properties which at present are not clearly defined. The availability of iron in the hemoglobin may be the determining factor in the growth of hemophilic bacteria and the second factor or substance may act by rendering this element more available. The suggestion may be made, in conclusion, that the activity of these substances in animals and higher plants may concern or somehow control the metabolism of certain elements like iron, phosphorus, calcium or iodin, as well as possible of protein.

Cases of Typical and Atypical Lymphosarcoma.—MACKENZIE (*Jour. Cancer Res.*, 1918, iii, 93) reports 4 cases of lymphosarcoma taken from the autopsy records of the past five years. Two may be classified as typical, since they conform with the characteristics of lymphosarcoma laid down by MacCallum, Sternberg, Paltauf and

Kundrat. Briefly these are tumor formation starting in a group of lymph nodes and spreading thence to neighboring nodes or follicles, with no general lymphoid involvement as in leukemia or pseudo-leukemia. True metastases by way of the blood stream are rare and usually isolated. The commonest sites of origin are the lymph nodes of the neck, mediastinum, mesenteric and retroperitoneal regions, less frequently the inguinal and axillary nodes. The affected groups form nodular, uneven masses, well limited in the beginning but later diffusely permeating the surroundings. The spleen and bone marrow are rarely attacked. Histologically the tumor is characterized by an irregular reticular framework with lymphoid cells in the meshes. The cells resemble lymphocytes but are larger and have a more lightly staining nucleus and a scanty, often almost invisible non-granular cytoplasm. There is no definite alteration of the blood picture. The other two cases not falling in this category, resembling each other in pathological anatomy and histological picture, are atypical lymphosarcomata. The main points which distinguish them from true lymphosarcomata are the early involvement of the lymph nodes throughout the body in a manner not suggesting regional extension, the distinct nodular metastases in liver and spleen, the inability to grow out into the surrounding tissue and the different cell components. The neoplasm is not leukosarcoma in which the splenic enlargement is due to a diffuse infiltration of the whole spleen by the abnormal cells and not to the presence of distinct nodules. It is hardly necessary to point out that the histological picture of Hodgkin's disease alone is sufficiently characteristic to make it unnecessary to indicate other points of differentiation.

HYGIENE AND PUBLIC HEALTH

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Hog Cholera and Paratyphoid Fever. Studies on the Paratyphoid-enteritidis Group.—KOHN and VALENTINE (*Jour. Med. Res.*, March, 1918, pp. 89–125) state that the tendency to variations, as well as the differences in avidity for carbohydrates, shown by otherwise similar types, has led to contradictory opinions as to the classifying significance of the cultural reactions of members of the paratyphoid-enteritidis group. By correlating the fermentative results, especially in relation to quantitative reductional differences, well-defined groups result, as shown in the tables presented. This grouping correlates

host origin and agglutinative differences. Bacillus choleræ suis and Bacillus paratyphosus "B" in this way are separable one from the other, and the Bacillus choleræ suis is therefore a distinct type, and most of the strains studied have been similar and constitute a definite subgroup. This indicates that Bacillus paratyphosus "B" is essentially a human pathogen and that paratyphoid fever due to this type is normally caused by the transfer of the bacillus from man to man, and that infected swine are not a source of contagion for this disease, either directly or indirectly, through the consumption of infected food.

Observations on Meningococcus Carriers and on the Bacteriology of Epidemic Meningitis. — During the summer and fall of 1917 MATHERS and HERROLD (*Jour. Infec. Dis.*, June, 1918, No. 6, xxii, 523) made an extensive bacteriological study of epidemic meningitis in one of the large military camps. The meningococcus carriers in the infected organizations were identified and isolated. For the cultures plain blood-agar was found to be satisfactory and the material for culture was obtained from the nasopharynx by means of a simple uncovered wire swab. It was found that 3 to 6 per cent. of the men examined were miningococcus carriers. The majority of these carriers, however, were of the temporary type; only 1.2 per cent. of the total number of suspects examined proved to be chronic carriers. Chronic meningococcus carriers, as distinguished from the temporary type, often harbor great numbers of meningococci in the secretions of the nose and throat. The number of carriers was found to be high among those coming in contact with meningitis cases. In a study of the biological reactions of 150 strains of meningococci from different sources two large biological groups were differentiated by means of macroscopic agglutination tests using monovalent serums. The agglutination reactions were in most instances definite and specific, but a number of atypical and inagglutinable strains were met with in each group. The atypical strains, however, did not differ enough from the other members of the group to warrant different classification as determined by agglutination. The classification of the inagglutinable strains was accomplished by means of agglutination with monovalent serums prepared from these strains; these serums yielded specific reactions with organisms of one or the other main type. The biological type of meningococcus predominant in the camp epidemic was identical with the type prevailing among the chronic carriers, but different from the type of meningococcus, causing the majority of the sporadic cases of cerebrospinal fever in Chicago. Also the type of miningococcus found in the cases and in the corresponding immediate contacts was in every instance the same. These facts suggest there is a close relationship between cases of epidemic meningitis and meningococcus carriers.

The Value of the Wassermann Reaction. — LARKIN, LEVY and FORDYCE (*Jour. Am. Med. Assn.*, June 1, 1918, No. 22, lxx, 1589) state that the term "Wassermann reaction" includes several methods of serological procedure. An accurate interpretation of each method is essential in arriving at a proper diagnosis. A positive reaction is the most constant symptom of syphilis. The value of the reaction in diagnosing undoubted syphilis is shown by the following facts: (1)

The reaction is positive in practically 100 per cent. of the cases of florid syphilis. (2) In active tertiary syphilis of the skin and bones the reaction is positive in about 94 per cent. of the cases. (3) In syphilis of the central nervous system cognizance must be taken of the reaction in both blood and spinal fluid; the blood is positive in 80 per cent. of the cases. (4) In a pathological study the Wassermann reaction (alcoholic antigen, warm fixation) was positive in 94 per cent. of cases of syphilitic aortitis. As a means of corroborating syphilitic infection the Wassermann test is at least 90 per cent. dependable, as shown in a series of positive reactions in which 90 per cent. could be accounted for by syphilitic changes in the aorta alone. The value of a negative reaction has been studied and its reliability confirmed by the negative reactions obtained in non-syphilitic affections of the skin. In a series of necropsies in which it was demonstrated pathologically that the aorta was free from syphilitic disease, negative reactions were obtained in 91 per cent.

Presence of Tubercle Bacilli in the Feces of Cattle in Dairy Herds.—Williams, Scott, Roberts and Hoy (*Veterinary News*, April 28, 1917, No. 695, xlv) state that this research is a preliminary to testing the viability of the tubercle bacillus when excreted on pasture land in the feces of cows. Incidentally it revealed a means whereby milk may become infected with tubercle bacilli from dung. To test the excretion of bacilli, guinea-pigs were inoculated with an emulsion of the feces. In all samples of the feces of 179 cows were examined, but for various reasons some of these were excluded from the final results. After such exclusions it was found that virulent tubercle bacilli were present in the feces in 3 cows out of 158. It is possible that one of these infecting cows should also be excluded, as she had been operated upon for tuberculous glands in the neck twelve months before the sample of feces was taken and was again obviously unwell. If, then, this animal be also excluded there remain 2 apparently sound cows whose feces infected guinea-pigs with tuberculosis from among 157 which were examined. By other methods it is possible that other cows might have been found to excrete tubercle bacilli in their feces. Only one sample was taken from any animal, and the sample represented only a very small fraction of the total daily excrement. Moreover, only a fraction of the sample taken could be inoculated into guinea-pigs.

Tuberculous Mastitis in the Cow, Its Pathogenesis and Morbid Anatomy and Histology.—McFadyean (*Jour. Comp. Path. and Therap.*, March, 1917, Part I, xxx) discusses the three views representing the route of infection of the mammary gland, namely: (1) by way of the milk canals; (2) by the blood stream from a preëxisting focus; (3) by way of the lymphatics from some tuberculous lesion in the abdomen. Against the theory of embolic infection are certain features of mammary tuberculosis: (1) The disease, as a rule, begins in one quarter of the udder and not in all four quarters. (2) In the great majority of cases it is a hindquarter which is first attacked. (3) The disease generally appears to have begun at the upper part of a quarter. (4) As a rule the lesions do not appear to develop from separate discrete centers in the quarter first attacked. (5) In certain cases, which are by no means rare, the supramammary lymph glands are found to be visibly tuberculous

while the entire udder tissue appears to be normal. The lymphatic theory, on the contrary, affords a perfectly satisfactory explanation of the whole of these facts. Infection through the teat canal is possible but rare. Attention is called to the common error in supposing that tuberculous mastitis is a nodular disease and that consequently palpation of a suspected udder should be directed to the detection of firm nodules. The disease is diffuse and increased solidity and firmness, without the formation of actual tubercles, are the more constant characters of the lesions.

The Four Essential Factors in the Production of Milk of Low Bacterial Content.—AYERS, COOK and CLEMMER (*Bull. No. 642, U. S. Department of Agriculture*) point out that the production of milk of a high sanitary quality involves a knowledge of the influence of numerous factors. To deal intelligently, therefore, with the influence of these factors, they must be grouped so as to bring together those which are of importance in connection with some definite phase of production. With this thought in mind the following group of factors were selected as a means of clarifying the subject. (1) Factors concerned in the production of milk which is practically free from visible dirt and which has a low bacterial content. (2) Factors most directly concerned in the prevention of infection of milk with pathogenic organisms. (3) Factors of importance in connection with the health of cattle. (4) Factors concerned in providing and maintaining conditions suitable for the production of a food product, even though they may not directly effect the quality of the product. The paper considers only the factors in group one. The experiments were conducted in a small barn with four cows. The general plan of the work, which covered about one and a half years, was as follows: At first the barn and cows were as dirty as possible, then one factor of improvement at a time was introduced, in order to obtain a milk of low bacterial content. When the essential factors were determined their value was checked by repeating the experiments. Extensive information is given in the paper on the contamination of milk by unsterilized utensils and manure and also the growth of bacteria in milk held at different temperatures. The experiments showed that the unsterilized utensils were a much greater source of contamination than manure and dirt. It is pointed out, however, that manure and dirt should be kept out of milk not only from a stand-point of common decency but because it assists in producing milk of low bacterial content and reduces the possibility of infection by disease-producing organisms, such as that of bovine tuberculosis. The results of the experiments indicate that it is possible for the average dairyman on the average farm, without expensive barns and equipment, to produce milk (practically free from visible dirt) which when fresh has a low bacterial count. By the use of three simple factors, which named in order of importance are sterilized utensils, clean cows with clean udders and teats, and the small-top pail, it should be possible on the average farm to produce milk which corresponds closely to milk as it leaves the udder of the cow. With these three factors it was possible during a period of two months to produce milk in an ordinary barn, 65 samples of which, when fresh showed an average count of 2154 bacteria per cubic centimeter. The value of these three factors

was demonstrated under practical conditions on six farms. A fourth factor of holding milk as near 10° C. (50° F.) is also absolutely necessary and increases in importance with the age of the milk. In connection with the production of milk of low bacterial content it seems evident from the results that undue emphasis has been given to factors and methods of minor importance, while those which directly affect the bacterial content have not been sufficiently emphasized.

Physiological Stimulation of the Choroid Plexus and Experimental Poliomyelitis.—Flexner, Amoss and Eberson (*Jour. Exp. Med.*, June 1, 1918, No. 6, xxvii, 679) record experiments which serve, in the first place, to confirm those of Dixon and Halliburton on the stimulating effect of intravenous injections of extracts of choroid plexus in the secretion of cerebrospinal fluid and extend their observations to monkeys. They bring out also the variable effects of the virus of poliomyelitis, variations affected by the quality of the virus and also by the individual powers of resistance to infection possessed by individual monkeys. These factors of variation must be taken into account in performing and interpreting experiments on infection and particularly those on immunity and specific therapy in relation to poliomyelitis. In general it may be said that experimental infection by way of the blood is not easy to produce in monkeys unless some contributing factor, such as the existence of a coincident aseptic meningitis, operates at the same time. And yet two of their experiments show that when the strength of the virus is great the injection of relatively considerable quantities suffices to induce infection and paralysis, but not in all instances. The chief outcome of the experiments has been to determine the fact that when the intravenous inoculation of the virus does not in itself suffice to induce infection and paralysis the intravenous injection of extracts of the choroid plexus, which in themselves excite the secretory functions which preside over the formation of the cerebrospinal fluid, is powerless to modify this result. This fact would seem to be of interest and importance, since it has already been shown that very slight structural changes in the meningeal-choroidal complex suffice to make possible or certain infection under these circumstances. Apparently mere augmentation, from time to time, of the secretory functions of the choroid plexus, through intravenous injection of an extract of the choroid plexus and while the virus is still circulating, is insufficient to ensure passage of the virus from the blood into the nervous tissues, upon which infection depends. Neither does the augmentation exercise a restraining influence on the development of infection otherwise capable of taking place.

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